Editorial

BY the time this issue appears on the streets, I will be somewhere in Europe on the first leg of a journey around the world. I am making the trip to see all I can of radio and electronics in other lands.

My general route will be through Italy, Switzerland, Germany, Holland, Belgium and France to England where I will spend some weeks. From England I will go to New York, work my way across to Los Angeles and San Francisco, and finally return home over the Pacific.

During the months I will be away, I expect to visit many of the world's leading radio and electronic centres where all kinds of equipment are designed and manufactured. I must say at once how kind my friends in the radio world have been in offering their hospitality and facilities without which such a trip would be fruitless. As it is, I am assured of making the most of every moment in a period where time will be the most valuable component.

Direct contact with activity in other parts of the world is becoming a necessity today for anyone who hopes to keep even reasonably abreast of the march of progress. Modern communications and the inevitable interchange of ideas, particularly in the scientific world, have drawn us so close together that isolation and self sufficiency are things of the past.

This is particularly so in the field of technical journalism, which assumes the difficult task of keeping touch with progress and achievement wherever it is found.

A magazine such as ours must also be prepared to express opinion and to pass judgment on what goes on around it, and neither can carry substantial weight unless backed by reasonable knowledge and experience.

During my absence I hope to send back some impressions of things I see and hear, and these will find their way in one form or another to the pages of the magazine. But my programme is a very tight one, and many interesting matters may have to wait until I return.

Naturally I am looking forward to meeting people in other countries, seeing how they live, talking to them about their ideas and their aspirations. After all, none of the rest has any meaning until it is integrated wth the everyday life of the world. Maybe what I learn will enable me to evaluate more accurately the worth of my native land.

John Moyle

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RADIO TELEVISION & HOBBIES

A NATIONAL MAGAZINE OF RADIO, TELEVISION, HOBBIES AND POPULAR SCIENCE

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OUR COVER PICTURE

Scientific research against food pests is allowing the world to grow more food. At the Imperial Chemical Labs in England, a scientist uses a special vacuum pump to remove dead aphides which have died after eating chemically-fed bean plants.

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FUNCTION SELECTOR
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PRESS FOR
Palec

Radio and Television

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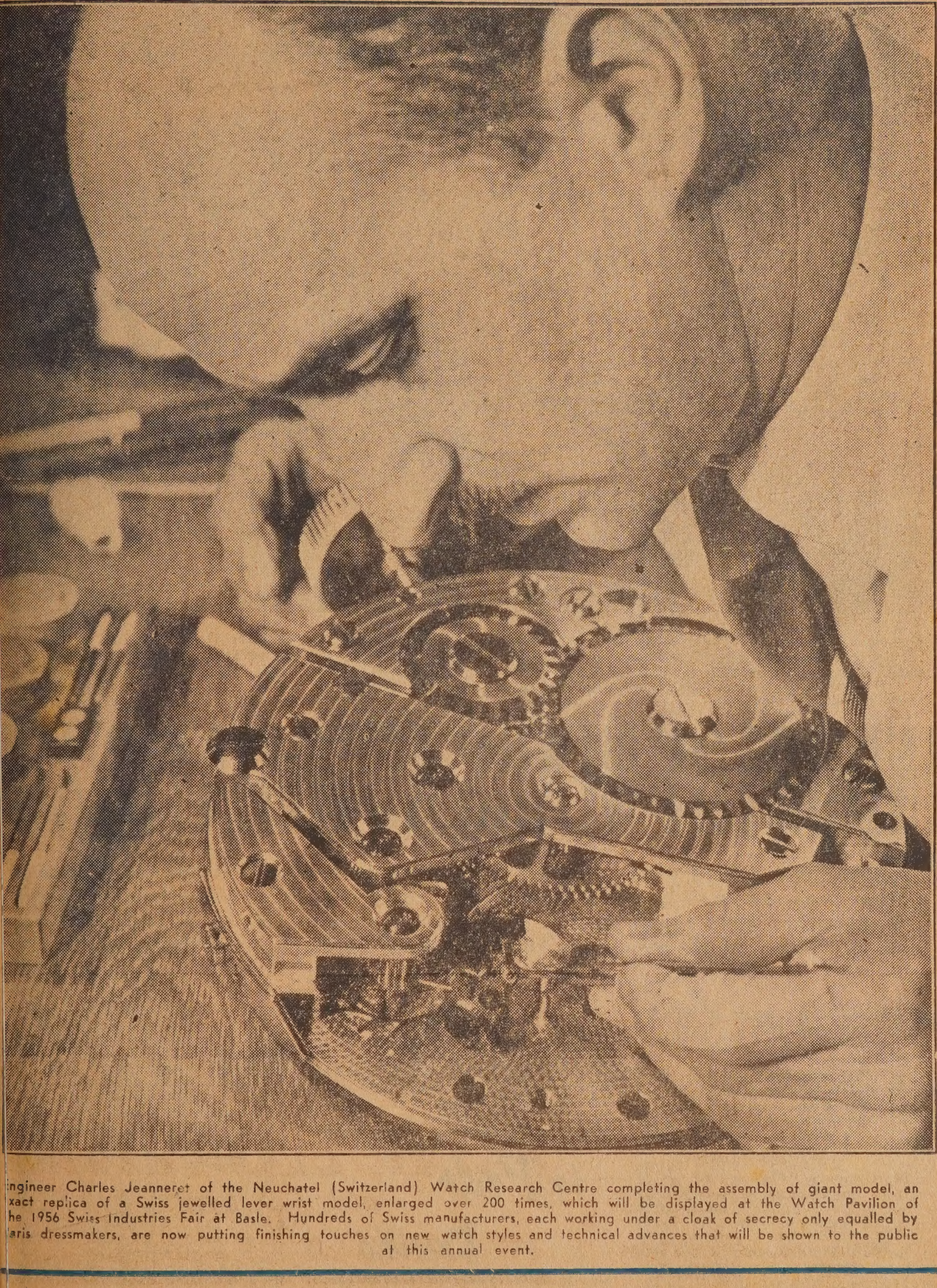
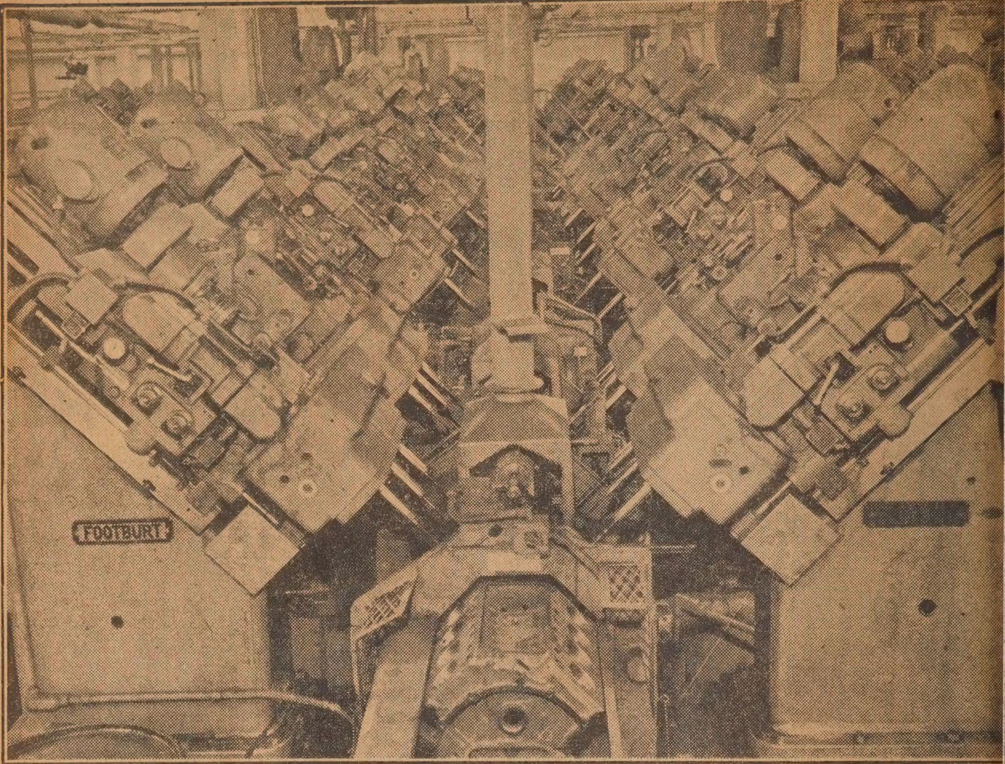
GIANT WATCH FOR BASLE FAIR



ngineer Charles Jeanneret of the Neuchatel (Switzerland) Watch Research Centre completing the assembly of giant model, an xact replica of a Swiss jewelled lever wrist model, enlarged over 200 times, which will be displayed at the Watch Pavilion of he 1956 Swiss Industries Fair at Basle. Hundreds of Swiss manufacturers, each working under a cloak of secrecy only equalled by aris dressmakers, are now putting finishing touches on new watch styles and technical advances that will be shown to the public at this annual event.



Cylinder blocks move in precision through the 80 tools of this 17-station transfer machine in Ford's Dearborn Engine Plant. In addition to drilling, reaming and countersinking holes in the V8 block, this machine also has two automatic inspection stations where metal "fingers" ascertain that the holes are drilled in the proper places and to the proper depth. Exhaust hoods close to the work stations keep the plant's air clean.

INDUSTRY NEARS AUTOMATIC AG

Automation is a word which you won't find in many dictionaries. This new kind of dynamic magic is on everyone's lips. It is a word which conjures up visions of the fascinating world of tomorrow. Some people see it as a push-button universe created by the comic-strip artists. Others see the more sober future portrayed by H. G. Wells in his moments of melancholia.

by Pedr Davis

WHATEVER the world of tomorrow will look like, we know today that it will certainly be shaped by automation.

But what exactly does the word mean? It is a new description of one of the oldest known habits of man: the ability to get the most work done with the least possible energy. A forthcoming edition of Webster's dictionary will define "automation" as "The act or art of having a manufacturing process fully automatic." A more down-to-earth definition was given recently, however, in Detroit by a vice-president of the Ford Motor Company. He said that automation only meant "improved machinery which will do the work that men formerly had to sweat to do."

During the past few years there has been a tremendous growth overseas of companies which produce machines that can "think" and carry out operations which once required keen intellects. There has also be
a wide-spread demand for "transf
machines" which eliminate huma
handling of components in t
machine shops and perform
machining operations automatical
without manual guidance. Su
units not only check their own a
curacy with electronic equipment b
they also automatically reject a
component which for any reason
faulty.

Economists noting the producti
potential and the low cost operati
of such machines predict that we a
on the edge of an entirely new e
— the age of automation.

There is no doubt that electro
manufacturing processes will chan

he world in which we live. They vill bring an entirely new concept f leisure and an abundance or con- umer goods to add to our standard f living.

FFECT ON INDUSTRY

Already such machinery is installed 1 the factories of a wide range of roducts which are cradling the new ra. Proud executives point to bat- ries of automatic machines occupy- ig thousands of square feet. Their oast is that the machinery will ow do the work of hundreds of men a fraction of the cost and time rmerly needed.

Some cynics scoff and say: "Ah! ut will the machines also pay nion dues and buy new motor cars?"

No! They won't. Nor will they eed to. Automation is to mass pro- ction, just as the mechanical reaper as to the sickle. It will speed up oduction and lessen costs, so that e average working week will be duced and the greater output will a prelude to richer prosperity.

Mr. Walter Reuther, fire eating esident of the Congress of Indus- al Organisations, recently predic- d that by 1965 the United States ould have a four day, 32 hour week.

There are numerous applications automation which could be quoted illustrate Mr. Reuther's prediction. ne of the earliest examples was the tomatic dial telephone which re- aced thousands of operators and tteries of switchboards.

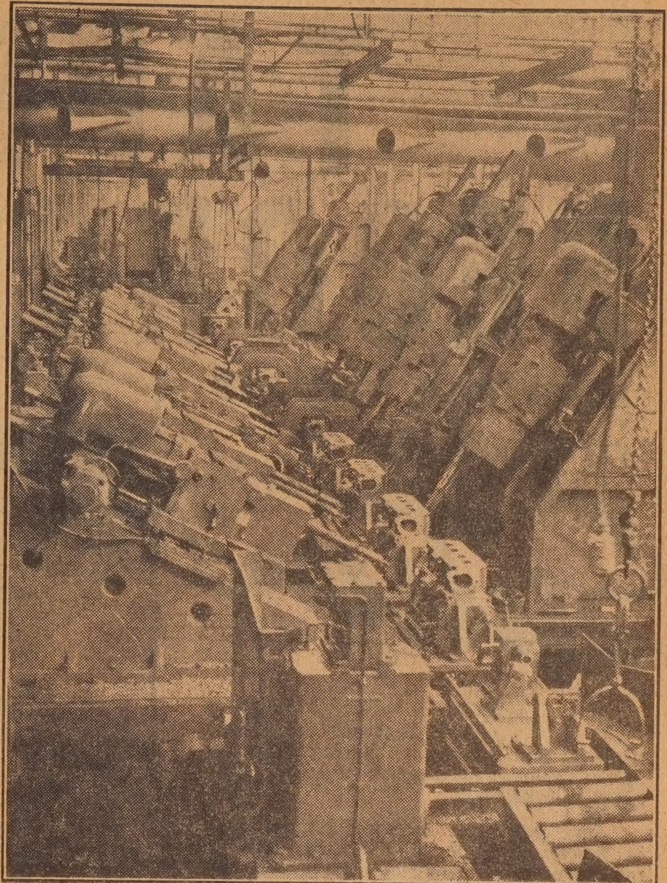
JTOMOTIVE INDUSTRY

Another advanced application of tomation is a machine just com- ted in the USA by W. F. and John rnes. It is designed to turn out o complete automobile cylinder ads a minute. Previously the me output required 40 skilled rkers operating 30 machines. The w machine requires only eight eratives as well as a small task ce to keep the involved hydraulic d electronic equipment (there are) miles of wire and 3000 electrical ntacts) in peak operation.

The same machine has also an im- essive piece of automated equip- nt known as a tool control board. stores cutting tools, records their e and signals a warning to the erators when they require chang- . Such a system is imperative. for n a few minutes' loss of produc- n on such a machine would in- ve financial loss running into eral noughts.

n the new Ford Motor Company nt at Cleveland, a series of elec- nically controlled machines, ser- ed by 250 skilled engineers, are l to produce twice as much work 2500 employees formerly did. The nplete assembly and machin- of cylinder block for a tor car takes only 15 minutes, ereas the previous time was nine rs. In one English factory, the k of 117 machinists is now e by 41 men — and pro- tion is higher than ever. another factory, radios are being embled at the rate of 1000 per by two men. A year ago, the e output required 200 men. At Austin Motor Company in Birm- ham, the entire assembly uence of the car is controlled by complicated Hollerith electronic hine. Engines are stored under- und, selected automatically when uired and delivered to the ap- priate chassis on the assembly . The rear axle and suspension system is also delivered in the same manner.

BODIES MOVED AUTOMATICALLY


This picture shows part of one of the many "transfer" machines now being used in producing all major mechanical components. Here cylinder blocks are being worked, and in addition to carrying out widely varied operations entirely automatically, the "robot" units check and inspect their own work, and have the power to stop the whole machine if one of the units is not doing its job properly. These machines cost less than conventional machines, occupy about two-thirds the space and require few operators.

ELECTRONIC MACHINES

In other departments of commerce, electronic machines are having equally dramatic effects on the economy of business. Electronic "brains" are being used for all sorts of things, from sorting post office mail to computing insurance rates. The Bell Telephone Company in America is said to be working on a super electronic "brain" which will supervise connection among 50 million subscribers in North America. It will enable the public to dial numbers in any city in the country, even those thousands of miles away.

Remington Rand, another US company, have just completed a giant brain which will make a complete inventory control for large companies, with a capacity equal to 39,000 standard machines.

An amazing demonstration of the ability of these machines was made recently by the Bell Telephone electronic mouse. His body is a permanent magnet, two inches long, his feet are three retracted wheels, his whiskers are copper wires. The "cheese" he seeks is an electrical terminal. Engineers put him in a maze about 2ft by 2ft composed of 40 movable aluminium partitions. In one corner is the cheese, reached by only one possible route. A touch of the switch and away goes the mouse in a headlong scramble. He bangs into a wall, bounces back, tries another direction with tireless energy until finally he reaches his goal. After about two minutes of hectic travel he reaches the "cheese" and a bell acclaims his success.

The engineers pick him up and start again. The second time he goes,

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H.M.V. EMICORDER, BYER "55" and others are also available at Suttons.

e mouse doesn't strike a single
all. He moves right to the "cheese"
ithout a single error. He cuts his
me from two minutes to 12 sec-
ıds! But if you place him on a
ırt of the maze which he hasn't
sited before, the scrambling and
ınging goes on until his electronic
orain" remembers the route. But as
on as he reaches a familiar sec-
on, he goes like a rocket, straight
r the cheese.

OOL REPLACEMENT

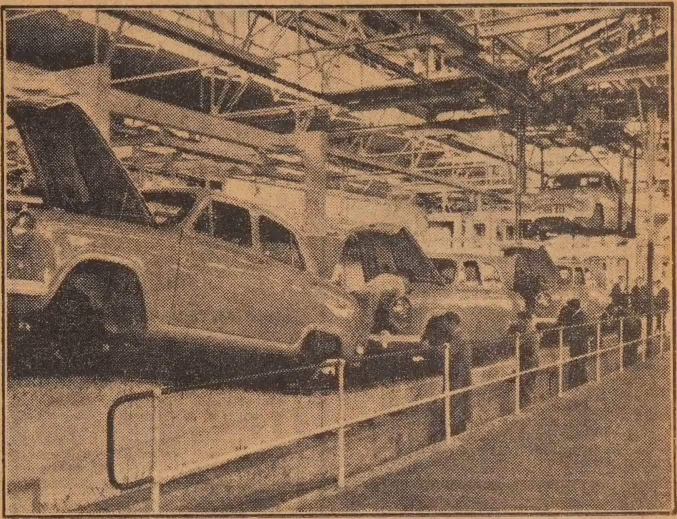
Production engineers are making
ually remarkable progress in de-
sing automatic machinery to carry
ıt operations formerly requiring
onsiderable technical skill on the
ırt of several operators. A limita-
on of their machines has always
een that the cutting tools wear and
omplete stoppage has been neces-
ıry whilst replacements were af-
cted. To restrict loss during such
eriods, the Cross Company of De-
oit have introduced "sectionised
ıtomation" in multi-section "trans-
r machines".

They have divided their machines
to several units, so that any one
ortion can be shut off without in-
rfering with other parts; space is
ovided between sections for bank-
g components should the next sec-
on be inoperative.

One machine recently built was
0 feet in overall length and was
pable of carrying out 550 opera-
ons on V-8 cylinder blocks. This
mprised 265 drillings, 6 milling, 21
oring, 56 reaming, 101 counter
ıking and 106 tapping operations.
addition, 133 automatic inspection
erations were carried out and
ıen 100 pc efficiency was attained,
oduction rate was 100 blocks an
ur.

Fords have another machine with
orodigious appetite. Rough cylinder
ocks are fed in one end, and com-
eted, assembled and tested units
ierge from the other!

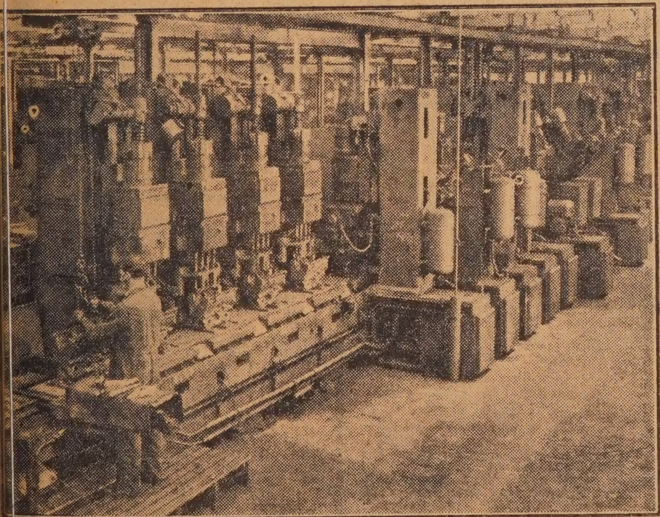
BODIES MOVED AUTOMATICALLY



The Austin Assembly Plant at Birmingham, England, uses a Hollerith electronic system to control sequence of operations. Whole body assemblies are lowered automatically on to the moving chassis—with an accuracy of one-eighth of an inch.

Equally complicated machinery is now in regular use for the production of pottery, typewriters, the cutting and checking of gears and the chromium plating of anything from a nickle to a bumper bar.

There are two types of automated machinery: the straight line transtype and the rotary index dial type. The latter kind are a development of the "Bullard" type of rotary machine, in common use in industry for years.



is is the largest single transfer machine in use at Longbridge. It has thirty-one
ations performing many hundreds of operations to A.40 and A.50 engine blocks.
nly two operators are required. The one in the foreground is unloading the
achined blocks, and the other, out of sight on the right of the picture, is loading.

TRANSFER MACHINES

Most transfer machinees operate on the principle of one operator loading at one end and the finished component being delivered at the other. They will electronically measure the work in all stages of machining and reject those components which are not up to standard. All the worker has to do is to watch the panels of red, yellow and green lights which indicate the functional efficiency of the machine.

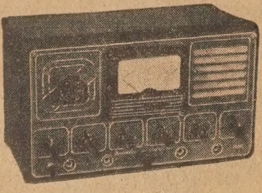
In addition to these types there are also the "mechanical production aids" which form the basis of production machinery. They include electronic switches, conveyors, elevators, loaders, turnover machines, rotation devices, tilting units and mechanical fingers.

Although the word "automation" is new, its principle is old. Henry Ford took the first steps in that direction in 1913 when he ordered his engineers to make everything possible in the plant automatic. Within ten years his production figures were nudging the two-million mark. He had 105,000 men on the payroll then. He has 177,000 now—and his production figures are roughly the same!

Pioneer achievements in this direction were also carried out by the Coventry engine division of Morris Motors in England. By 1925 they were producing the cylinder block, flywheel, and gearbox on "semi-automatic continuous machines" as a technical journal of the day described the operation. It is interesting to note that Sir Leonard Lord, now chairman of the British Motor Corpoartion was then machine tool engineer, in charge of the design of these automatic transfer machines. Today, the

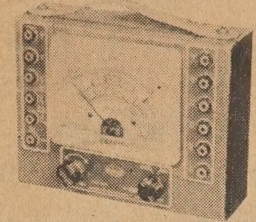
(Continued on page 19)

UNIVERSITY service aids . . .



SIGNAL TRACER and V.T.V.M. —MODEL AST

Here is a Sensitive Signal Tracer with a Vacuum Tube Voltmeter which brings fault finding in service work to a stage where faults can be quickly located and analysed. Brief specifications are: Power: 240 volts, 40 to 60 cycles. VTVM: 0/5, 0/25, 0/100, 0/500 Volts AC and DC. The signal tracer covers from 175 kilocycles to 18 megacycles. A leaflet is available on request.



MULTIMETER—MODEL MK1

Has a wide range of AC and DC voltages up to 1000 volts and measures current in the range of 1, 10, 50 and 250 milliamperes, and resistance readings up to 100,000 ohms. Has U4 square meter with clear Multi-Scale. Supplied either as a kit or assembled. Assembly from the kit of parts is easy; wiring instructions and constructional details are given and photos and diagrams make the job easy. Write for details.

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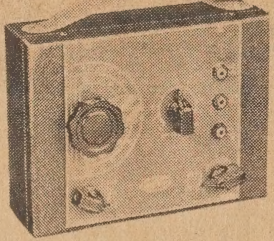
Model YOA. Gives dynamic on-the-beam performance, and new Vernier or fast drive dial makes for quicker and easier tuning. Has improved attenuation system and the dial is calibrated in spot frequencies for quick tuning over the main alignment points merely by changing the switch. Has continuous coverage from 30 megacycles to 150 KC in overlapping bands. Write for free illustrated leaflet.



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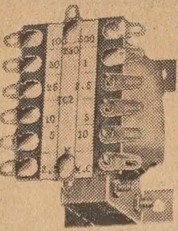

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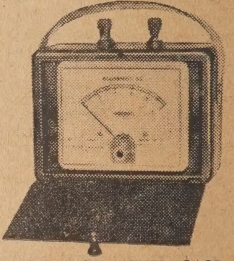
Model B13: Although this high voltage probe is primarily designed for 30,000 volts test circuits, it offers a wide number of uses where polystyrene probes are required. It can be used for signal tracing work, high voltage work or a variety of other applications. Available with red or black handle as required.



PORTABLE METER CASE MODEL B21

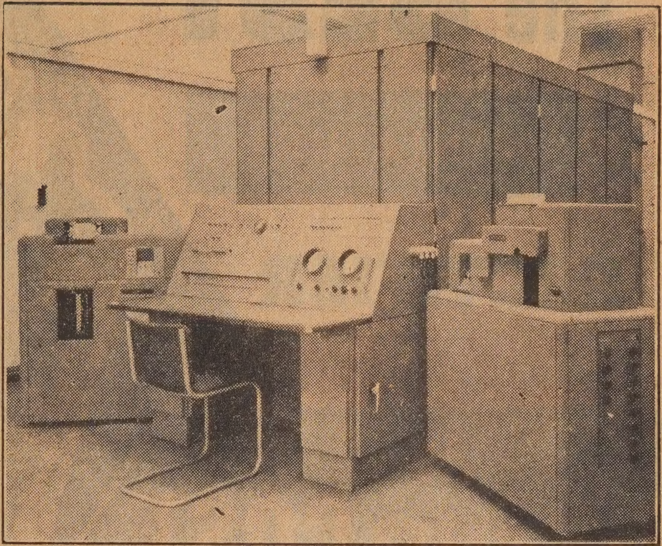
The case illustrated here is of hard moulded rubber, yet with sufficient resiliency to stand shocks and be unbreakable. It is supplied ready drilled to accommodate Models U4, W4 or R4 meter and is supplied with two terminals and carrying strap handle. A flap lid is fitted to the case so that the meter can be protected when not in use. Because of its insulating qualities this can be used for relatively high voltage equipment and provides a convenient method of employing portable meters for any industrial or electrical uses. Any range of meter can be fitted.

SHUNTS

A complete and comprehensive range of heavy duty shunts and light duty shunts are available. These vary from shunts in the microampere range up to heavy duty shunts of thousands of amperes if necessary. Popular in radio testing are the light duty "R" type shunts, which are small and easy to use and are adequately protected in a moulded bakelite tube. The ends of the shunt are brought out to pigtails which allow quick and easy mounting. Normally these milliampere shunts are supplied to match 0-1 Milliammeters rated at 100 millivolts and are supplied in standard ranges of 5, 10, 25, 50, 100, 250, 500 and 1,000 milliamperes. Standard values for ohm ranges are also available. Price: 9/- each including Sales Tax.

MATHEMATICS BY ELECTRONICS

Fortunately all mathematical calculations resolve themselves ultimately into addition, subtraction, multiplication and division. The invention of the thermionic valve has made it possible to build automatic computers capable of performing these operations at very high speeds.



The digital electronic universal computing engine known as "Deuce", which is in use at Britain's National Physical Laboratory at Teddington, near London. It can perform many intricate calculations arising from problems associated with such things as the flutter characteristics of aircraft wings, trajectories of missiles, radar navigational charts and stress analysis.

N calculating machines of the digital type, the quantities in the oblem are represented by sets of ectrical pulses, and the number and rangement of the pulses in each t represent the value of one of the iantities. The machine is able to unt these pulses very rapidly and add sets of pulses and perform me other simple operations. It is ovided with a programme which ables it to perform very complex lculations by breaking them down to a series of simpler operations.

Outstanding examples of digital lculators are the two general purse electronic computers, "Ace" and Deuce", at Britain's National Physcal Laboratory, where they origined. "Deuce" was built by the Engh Electric Company Ltd., and is engineered version of the pilot odel, "Ace".

Both machines work at prodigious eeds, the time taken to carry out computation such as 3,971,428,732 3,167,292,438 being about one fivendredth of a second. The pulses generated at the rate of a miln a second and therefore pass a rticular point at the rate of one lse for every millionth of a second.

Long and intricate arithmetical problems occur nowadays with increasing frequency in research, industry and administration. Many of them require such an immense quantity of computations that, even using desk calculators, a trained mathematician might take weeks or months to carry out the work.

OVIDING A MEMORY

The pulses are used to indicate figure 1 and the gaps the figure All calculations are carried out using these two digits only. When sum is put into the machine the mbers are first translated into the ary scale; on completion of the culation the result is re-translated o ordinary numbers.

The machine may have to combine results of a dozen or more parate calculations; since it can y do one computation at a time, it st remember each one until it is nted.

The "memory" is provided by a red system. A disc has a number concentric tracks, all of which ve a collection of digits on them. cording heads, according to the trol impulses received, take off numbers and feed them into the tem. Recording is not erased, of rse, but remains in case it is nted again. This gives a much ger memory than the system of mercury delay lines that was formerly used in "Ace".

Instructions are given to the machine by coding them as holes in punched cards, which are fed into a specially adapted Hollerith accounting machine connected to the computer. The holes in the cards start momentary electric currents which release corresponding trains of pulses: these pulses are distributed to and stored in the memory loops.

As soon as the computer is loaded with numbers and instructions it begins on the calculations. The results are passed to the Hollerith machine, which punches another set of cards in accordance with the impulses received from the computer, and translates the punched holes into ordinary printed numerals.

Though the computer can only calculate with binary numbers, the input and output arrangements are such that it can convert decimal numbers into binary form and vice versa. Input numbers and instructions can be accepted in either binary or decimal form, or even one in binary and the other in decimal at the same time.

The mechanism that controls the sequence of the calculations is far more complex than the calculating mechanism itself. The preparation of the instruction cards is a specialised job sometimes requiring considerable mathematical ingenuity. Instruction programs for standard calculations are stored in a library. For a particular program the instructions are assembled for these prefabricated units and linked together by special instructions.

"Ace" and "Deuce" are enabling the Mathematics Division of the National Physical Laboratory to perform many intricate calculations arising from problems such as are associated with the flutter characteristics of aircraft wings, trajectories of missiles, radar navigational charts, surveying, load distribution in electrical power networks, stress analysis, crystallography, atomic energy and traffic control.

The importance of these versatile computers to industry is well illus-

By A. G. THOMPSON

English journalist and feature writer who has specialised in technical subjects.

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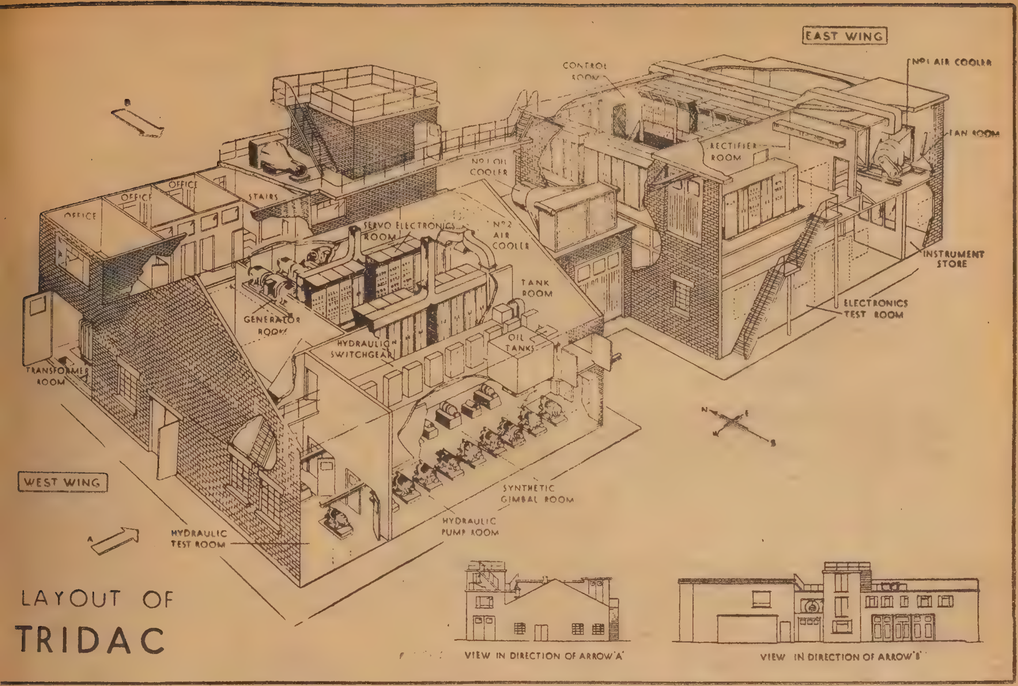
EAST WING
CONTROL ROOM
No1 AIR COOLER
FAN ROOM
RECTIFIER ROOM
No1 OIL COOLER
STAIRS
OFFICE
OFFICE
OFFICE
SERVO ELECTRONICS ROOM
No2 AIR COOLER
TANK ROOM
INSTRUMENT STORE
ELECTRONICS TEST ROOM
GENERATOR ROOM
HYDRAULIC SWITCHGEAR
OIL TANKS
TRANSFORMER ROOM
N
E
S
WEST WING
SYNTHETIC GIMBAL ROOM
HYDRAULIC PUMP ROOM
A
HYDRAULIC TEST ROOM
LAYOUT OF
TRIDAC
VIEW IN DIRECTION OF ARROW 'A'
VIEW IN DIRECTION OF ARROW 'B'

The layout of "Tridac", Britain's largest calculating machine, which is in operation at the Royal Aircraft Establishment at Farnbrough, southern England.

ated by their contribution to lens esign. A lens is a complicated ructure and the designer can only ake an informed guess as to what hange in shape is likely to result an improvement. He has then work out the paths of the rays light through the lens. With, y, ten refracting surfaces the calulations take about eight days. Ace" has done them in less than 5 minutes.

SE IN INDUSTRY

The instructions took about a eek to make, but the machine ould then work out any problem lens design and the instructions e now available for all lens probms.

The biggest calculating machine Britain is "Tridac", which cupies 6000 square feet of floor ace, uses 8000 valves, and under ak conditions absorbs about 650 ilowatts from the supply mains. Tridac" is in operation at the Royal ircraft Establishment at Farnrough in southern England. A rticular feature of this machine that it can deal with problems which a radar beam, or an airaft flying under automatic conol, moves with complete freedom any direction in space.

ESIGN OF TRIDAC

"Tridac" was designed jointly by e Establishment and the manufacrers, Elliott Brothers (London) d. With existing techniques digil machines cannot carry out large umbers of operations simultaneously r sufficiently quickly when exeited in sequence), to permit the production of involved problems on a real time scale. "Tridac" was, therefore, designed on the analogue principle, in which a physical quantity, such as a voltage or shaft angle, varies continuously in proportion to the quantity it represents. Thus one voltage might represent the forward speed of an aeroplane according to a pre-arranged scale of, say, one volt to ten miles an hour, while a shaft angle might represent the altitude of the aircraft on a scale of one degree per hundred feet. This system allows parts of the real system to be included in place of the machine calculation.

The basic analogue quantity in "Tridac" is a direct current voltage and the basic element in the majority of the computing units is a high gain DC amplifier with input and feedback impedances arranged to give an overall transfer function corresponding, for example, to addition or integration.

To avoid errors due to drift, each amplifier is stabilised by association with a separate driftstablising alternating current amplifier. To facilitate servicing, all the amplifiers and similar units are built in "brick" form; that is on small chassis which slide into pigeonholes in the cabinets. There are 44 cabinets con-

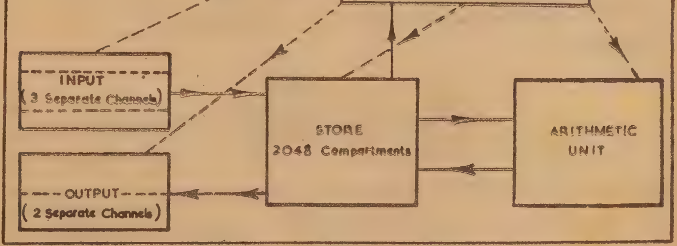
Diagram of basic units of LEO
Transfer of pulses
Control of operations
CO-ORDINATOR
INPUT
(3 Separate Channels)
STORE
2048 Compartments
ARITHMETIC UNIT
OUTPUT
(2 Separate Channels)

This diagram shows the basic units of "Leo", a fully automatic electronic computer designed for commercial use. It is owned by the London catering firm of J. Lyons and Company Ltd.

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Tannoy 12-inch Dual Concentric Loudspeaker c/w Crossover Network — £75 each

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ORTOFON Magnetic c/w input transf.	£15/6/8
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Dual Model 280 Auto Player	£24/15/-
Dual Model 1003 Changer	£35/12/-
Garrard Model RC90	£26/5/6
Garrard T Player	£13/8/-
Collaro Player	£11/10/-

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Leak TL10	£70/7/-
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Goodmans Audiom 70	£31/1/9
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Rola 12UX	£22/5/-
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AE/9 Enclosures unpolished	£11/9/6
polished	£13/16/-
AE/12 Enclosure sanded for painting	£12/8/3

All Vents as recommended by Speaker Manufacturers can be supplied—including Sand Filled Enclosures.

TAPE RECORDERS

Pyrox	£135/8/4
Tecnicorda	£149/2/-

REPLACEMENT PICK-UP HEADS

Plug-in white shell type No. AEX-P5SA, complete with variable reluctance pick-up and type AEJ-010A stylus

PRICE £9/3/9

Plug-in white shell type No. AEX-P5SD complete with variable reluctance pick-up and type AEJ-013A — (Diamond Microgroove Stylus). **PRICE £16/15/6**

THE AUDIOTORIUM

HIGH FIDELITY SOUND CENTRE

A DIVISION OF AUDIO ENGINEERS PTY. LTD.

422-4 KENT STREET, SYDNEY. BX6731

taining in all 2000 bricks of which approximately 600 are DC amplifiers, 350 mechanical chopper stabilisers, and 250 magnetic modu-ator stabilisers.

Another major section of the computer is a group of nine electrically-controlled hydraulic servo motors. Each servo is provided with its own 5 horse-power electric motor and horse-power electric motor and pump delivering oil at 2000 pounds per quare inch to the main hydraulic valves. A common low pressure pump delivering oil at 2000 pounds er square inch to the main hydraulic high performance servos drive assays f potentiometers, of which there re about 224. A central generator oom housing rotating machinery upplies power at various voltage evels and frequencies to the entire imulator.

Before any calculations can begin h "Tridac" a large amount of in-ormation has to be supplied. In he case of numbers which will not hange as the problem proceeds, ch as the size of an aircraft ing, or the relation between the udder deflection and the rudder-ar deflection, there are up to 2000 otentiometers, which can be set efore calculation begins. For nown variations, such as the hange of speed of sound with eight, specially shaped cams and otentiometers are available.

UTOMATIC PLOT

"Tridac" can automatically plot e position of an aircraft on a sheet paper or a map of suitable scale. can perform the required calcu-tions no matter how the speed ries; in fact, it can even calcu-te the speed from the engine rust. The latter is in turn cal-lated from the throttle settings d the engine characteristics.

These calculations take into ac-unt the effects of changing trim the aircraft as fuel is used, and e changes of aerodynamic drag d engine efficiency with chang-g height. Variations in the direc-on of flight are calculated by per-rming mathematical operations, hich represent the angles of de-ction of the aileron, rudder and evator, account being taken of ch factors as the change of air w over a wing or control sur-ce when the direction of the flight anges.

In the case of a fighter aircraft asing a bomber, the motion of e bomber can be reproduced by ting into the computer a pre-ranged progam, which may include riods of straight flight, slow turns, violent evasive manoeuvres. "Tri-c" will then calculate what sig-ls the radar set in the fighter ll produce. All the calculations carried out at the same speed the actual events occur.

UIDED MISSILES

Similar calculations can be per-med for guided missiles. Guid-ce in the launching phase is fair- simple, the missile being gath-ed into a cone of radio waves, hich puts it in the right direction. d-course guidance may take the m of either beam riding or the mmand system. In beam riding radar set based on the ground in an aircraft forms a narrow m up which the missile is fired. e command system consists of separate, fire-control radar sets ked with a computer.

When the approach of an enemy aircraft is signalled, one set begins to track the plane as soon as it comes within range. The missile is launched at a suitable moment and its flight-path is tracked by the second radar set. Signals from both sets are fed into the computer, which continuously plots the path which the missile must take to intercept its target. The computations are automatically signalled as instructions to the missile.

TERMINAL GUIDANCE

Finally, there is terminal guidance, which may consist either of passive homing, when the missile is attracted by a source of energy, such as heat or noise given off by the target, or of active homing, in which radio signals transmitted from the missile are reflected back to it from the target.

The use of "Tridac" for performing the calculations involved in guided missile systems will reduce the number of actual missiles which need to be fired for test purposes,

Almost all existing electronic computers have been designed to handle mathematical and scientific problems, in which numerous mathematical operations have to be done on a small input of data. In large-scale repetitive clerical work, however, comparatively few mathematical operations must be done on a large input of data and the volume of results is immense.

In operation at the Cadby Hall, London, headquarters of the catering firm of J. Lyons and Company Ltd., is "Leo", Britain's first fully automatic electronic computer desinged for commercial use. It is based very largely on an experimental computer constructed at Cambridge in 1948 and its calculating mechanism is not appreciably different from that of other high-speed automatic calculators. High-speed ancillary equipment had to be developed, however, in order that data might be fed into the calculator and results printed out more rapidly than had previously been possible.

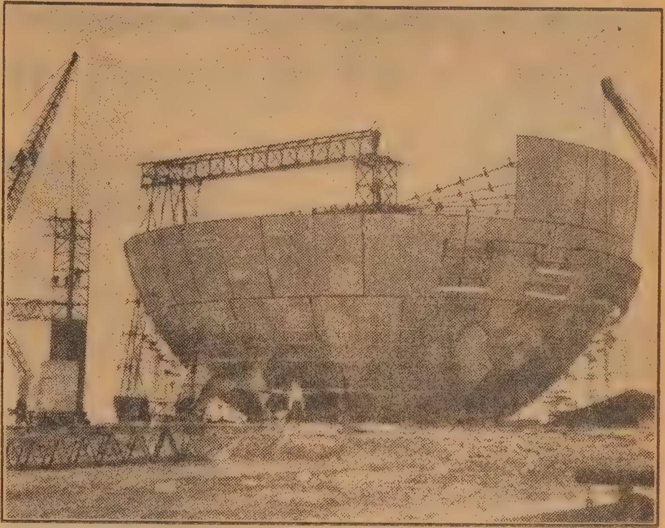
"Leo" might be described as the harbinger of a revolution in the keeping of commercial and industrial accounts. It is far more than just an electronic computer—it is an automatic office performing complete clerical jobs from beginning to end in one continuous operation, instead of merely a section of a job where the remainder is dealt with by orthodox clerks, the latter factor controlling the speed of the whole job.

PREPARES PAYROLL

It prepares the pay roll for 10,000 employees, taking into account 20 different items personal to each employee. The orders necessary to do the job are fed into the store in the form of punched cards and of punched tape. While doing the calculations for one man the machine draws information ready for the next. As soon as it has the answers it sends them out for printing, and while printing is taking place for one man the calculations are in hand for the next. The computer takes only about a second to do all the calculations and the pay-slips are printed simultaneously.

"Leo" can also be used for ledger-keeping, stores control and cost accounting. In fact, all types of clerical work that involve repetitive calculation are within its scope. It is anticipated that eventually it will be doing the work of between 200 and 400 clerks and tackling jobs that would have been quite impracticable by more orthodox methods.

BREEDER REACTOR IN BRITAIN



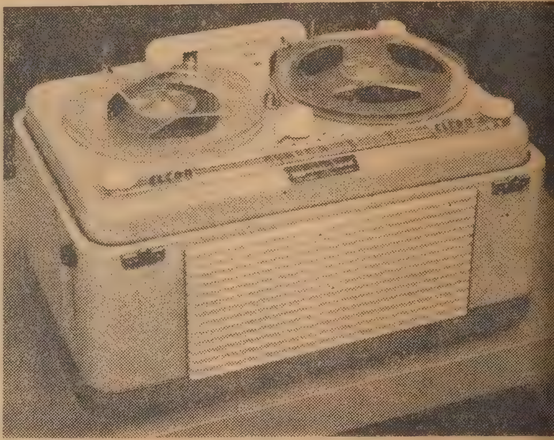
This huge steel sphere, shown almost half completed, is just 135 feet in diameter, and will house the experimental British atomic breeder reactor at Dounreay in Scotland. When completed it will supply electricity to the Central Electricity Authority.

MAGNETIC SOUND INDUSTRIES

NOTHING BUT TAPE RECORDERS'

THE ONLY TAPE RECORDER SPECIALISTS

Only Peter Clark of Magnetic Sound Industries can give a SPECIALISED tape recorder service. Only at Magnetic Sound will you see a full range of new model tape recorders, amazing values in reconditioned recorders. Only at Magnetic Sound can you have specialised hiring and servicing of all makes and models.



ELCON Choose from the two brilliant Elcon models; the Radiocorder (radio and tape recorder combined) and the Standard (high quality tape recorder). Radiocorder is **£143 or £25 dep.**, Standard is **£121 or £19 dep.** (Both full Guaranteed by Peter Clark).

Tape Recorders from £65 & £10 dep.

TECNICORDA

Ideal tape recorder for the home movie enthusiast. Excellent for adding sound to silent movies. Fine reproduction for music and speech.

£149/2/- or £25 dep.

GRUNDIG **JUST ARRIVE**

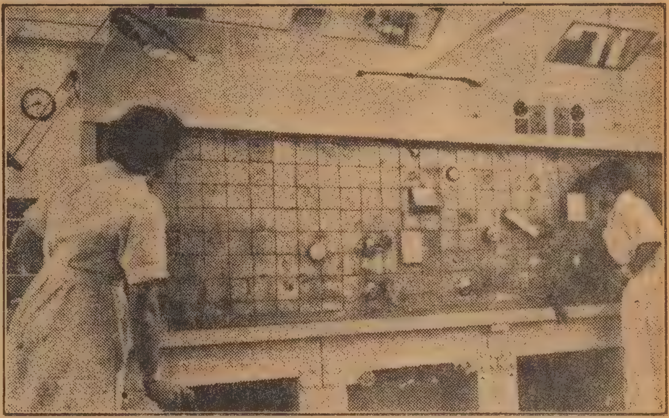
Unforseen circumstances excepted, Magne Sound will have a small shipment of the ma nificent Grundig tape recorders this month. Mo TK12, latest push-button operated, superb fini and styling. **£157/10/- or £35 deposit.**

387 **MAGNETIC SOUND INDUSTRIES**
GEORGE STREET (OPP. STRAND ARCADE) ON THE FIRST FLOO
PHONE BX4440-BX4586

RADIOACTIVE TRACER TECHNIQUE

Mr. Careful sat listening to the choir on the stage with feelings of complete satisfaction. The concert was a great success and he felt he had some part in its excellence. Somewhere in that array of a hundred girls, all dressed identically alike—as alike in fact as atoms of the same element—was his daughter Jane. His friends around him were more than surprised at the ease with which he was able to spot her.

By
Dr. A. D. MERRIMAN
G.C., O.B.E



Solutions of radioactive isotopes for medical use are dispensed, bottled and sterilised—all by remote control. The photograph above shows the dispensary for gamma emitting isotopes. It is screened by 4in of lead and operators observe the work through 6in lead glass windows and by mirrors suspended above the plant.

BUT Mr. Careful had put a tag on Jane. The blue hair-ribbon that each girl wore had, in Jane's case, been soaked in a special dye. When looked at through that small piece of orange-colored glass that he held, Jane's ribbon alone showed up bright scarlet. It was thus quite easy to trace her among all the other girls.

This home-invented but elegant tracer technique which Mr. Careful had applied had proved useful on other occasions and he expressed himself as quite confident that he could find his daughter even if she were one of a crowd at an international jamboree.

A similar technique for atoms would not, of course, be possible if only because individual atoms cannot be seen. But they can be heard, in certain circumstances.

The tracing of atoms is a much more complex business than locating a person in a crowd. Even in a very small amount of matter there are millions of millions of atoms and they are not all of the same kind.

USE OF TECHNIQUE

Why therefore is the tracer technique so useful or indeed why is it useful at all? In chemical and biological changes atoms move about and combine with one another in certain ways.

To begin to understand how and why changes occur scientists must first discover the movements of the atoms and the combinations into which they enter. The possibility of doing this depends upon the fact that in similar circumstances the same kind of element always behaves in the same way—which is more than can be said about people.

Atoms are labelled or tagged in a yclotron or in an atomic pile where they become radioactive. However the atoms may subsequently be combined with other atoms, they still retain their radioactivity and this property can be detected by the use of a photographic film or a Geiger-Muller or scintillation counter.

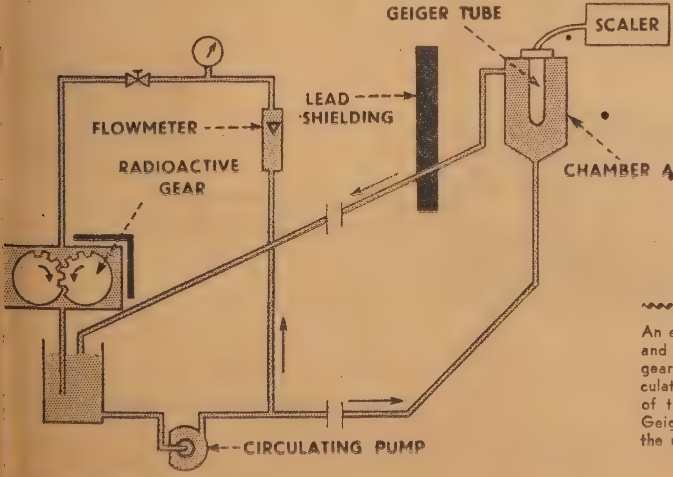
Everyone will know that the printing of cloth is done by passing the cloth over a number of rollers each of which is fed with a differently colored dye. It is easy to appreciate that some of the dye from the first roller will be carried by the cloth to the second roller where it will contaminate the second color.

And from the second roller the contamination will pass to the bath feeding that roller. It is most difficult to spot the contamination while the cloth is being printed and the colors are still wet.

But if it is not noticed at a very early stage the one end of the cloth will show a different color pattern from the other end. To obviate this most undesirable result a small amount of radioactive tracer is put into the first dye bath. The usual substance is radioactive phosphorus.

A Geiger counter is placed in the second bath and when a certain small amount of contamination is

(Continued on Page 119)



An experimental apparatus used to test gear wear and the effectiveness of lubricants. One of the gears is made radioactive, and the lubricant is circulated through the glass by means of a pump, part of the oil passing to the chamber fitted with a Geiger counter. The latter records the increase in the radioactivity of the oil as the radioactive gear wears away.

The Whirlpool Nebula, the plane of which is perpendicular to our line of sight, reveals the spiral pattern in all its subtlety. Located in Canes Venetici, it was the first spiral to be found. This photograph was made by the 200-inch telescope on Mount Palomar.

NEW THOUGHTS ON OUTER SPAC

Distant island universes, interstellar space and the zodiacal light provide astronomers with material for study during the coming geophysical year.

by Calvin Walters

DURING the past few weeks I have had plenty of time to contemplate on the mysteries of life and the universe. I am recovering from a slight operation which, I am assured, will enable me to continue these discourses for a long time to come.

Hospital is a good place to meditate on life. One has plenty of waking hours. No sleep is allowed for in hospital routine. The day is began at about 4.30 am with a nurse wheeling a rattling traymobile along the corridors full of cups of tea (the traymobile not the corridors).

VITAL STATISTICS

At five o'clock she reaches your room where you have been awake for the past half hour. This has also allowed plenty of time for the tea to get cold. You pour this into the receptacle.

You can't go to sleep again and at about 6.30 your room is invaded by several nurses with wash basins and so on. You are turned over and over and upside down without regard to the hemstitching in the tummy and after about half an hou you are left sore and miserable unt breakfast time about 7.30.

This sort of thing goes on all da long until lights out at 8.30 p You then are subjected to all kin of noises. Trays rattle, babies cr dishes crash, lights go on and o nurses run up and down the co ridors, bells ring. In spite of th you manage to doze off about o'clock and about 1.30 am you a wakened by a torch light shining your eyes with a nurse's voice sayi "would you like a sedative to se you to sleep". You then give up a lie awake contemplating whatever is you like to contemplate.

It so happens that I like to co template on things scientific and m thoughts ran to some of the problen which astronomers will attempt solve during the International Ge physical Year 1957-1958.

It can be said that the 21st centu is now in the making. The treme dous strides taken since about 18 have paved the way for science such an extent that new laws, a new techniques have opened up vista so wide as to stagger t imagination.

THE MILKY WAY

Consider for a moment that 1905, astronomers considered th all the stars visible in the sky we contained in our own Milky Wa system and that the system was mere 700 light years in diameter. light year is the distance which lig travels in a year at a speed 186,000 miles per second. It is abo 6-million-million miles.

With the rapid advances made instruments and technique it is no known that the Milky Way is not le than 100,000 light years in diamet and is only one of many more simil systems spread out in space. T new telescopes have located hundre of galaxies like our own and mu larger. One such galaxy has bee located at an estimated distance 500-million light years away.

Our Milky Way system is a tr mendous aggregation of stars a ranged in a huge elliptical spiral. gain some idea of its size consid the following. Situated somewhe near one focus of this elliptical spir is our Sun with its associated plan tary system. The whole Milky W revolves about a centre. Thus t Sun and Planets and indeed eve star in the Milky Way is "slowl moving around this centre.

At the Sun's distance from t centre the speed of rotation is abo 180 miles per second. At this spe it takes 225-million years for t Milky Way to make one turn.

The number of stars in the Mil Way has been estimated at at le 40,000-million.

Our Milky Way system is one of he smallest. The Andromeda Nebula ome 2-million light years distant ontains over 100-million stars and is nany times larger than our own. 3ig as we think we are, we are as othing compared to some of the iants of the universe.

One of the big questions in the stronomical world is, "Why do the alaxies show a spiral form?" Most f them do and some of them o not. This fact has led to the upposition that there is an evoluionary sequence going on.

PIRAL FORMS

If we look around us we will e struck by the fact that nature s very fond of spiral forms. There s the shell of the snail and many ea animals. The fern in a proess of uncurling. The hurricane nd tornado. The water as it runs own the plug hole in the washasin. There are many forms of the piral in nature.

It was at first thought that all he galaxies were spiral, but with he increasing power of telescopes t has been possible to divide alaxies into three types—irregular, piral and elliptical.

Astronomers are now thinking hat these three types represent hree stages in the development of galaxy. It is noteworthy that nost of the purely elliptical galaxies re small and faint while the spiral nes are very large and spectacular-y brilliant.

It is thought that the spiral apearance of these distant island unierses is brought about by rotaon. The distances are so great nd the diameters of the galaxies o fantastically immense that a ovement around an arc of a circle f millions of miles is not discernble to anyone in a lifetime. It , therefore, impossible that any ving person at any time will oberve any change of the position f a galaxy which would indicate otation.

VAST MAGNET

It is known that a spiral sysem contains gas, dust and stars, ut why the spiral arms develop is ot known. One theory looks upon galaxy as a vast electro magnet ith currents of electrons flowing rough the thick, troubled eddies gas and dust moving about its ntre.

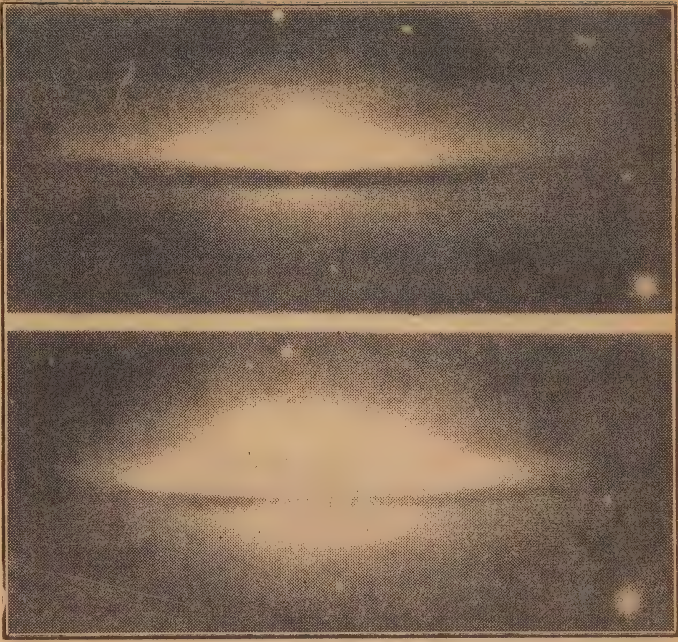
It is hoped that the matter will partly solved by means of the w techniques available during the ming Geophysical Year.

If the problem is solved it is difcult to see what influence it will ave on our daily lives. Perhaps may be found that cosmic rays nanate from such distant galaxies that the electromagnetic charter of the galaxies, if any, has me influence on our weather or dio communication or even our ealth.

At present such excursions into nitless space seem directed more ward solving the mystery of the igin of things and satisfying an's thirst for knowledge.

Was there a beginning of everying? If there was then there ust have been nothing in the first ace. This means that something as made from nothing. We canot conceive this idea. Neither can we conceive something without a beginning. So there we are. Or are we?

GALAXY VIEWED FROM AN EDGE



Two populations of stars are shown in these photographs of the galaxy N.G.C.4594. The top photograph made in blue light by the 100-inch telescope on Mount Wilson, tends to show Population I. Our Milky Way would look something like this when viewed edge on from another planet.

WHAT IS SPACE?

Yet, for all this mystery, outer space is a fascinating place to play in. Once you get on to this theme you forget all worldly worries. Business can go by the board. Bills can remain unpaid. Operations are forgotten, and your mind dwells in a world of awe-inspiring wonder and spectacle, unless you start to think of empty space with absolutely nothing in it. Not even a star or a planet or even a living thing. Then you can easily become a subject for the psychiatrist.

That brings me to another matter, which scientists have been trying to find out. What is in the space between the stars?

Up to 25 years ago the space between the stars — interstellar space —was considered as something to let the light of the stars shine through. New instruments and techniques have given that idea a good "back-hander".

The discovery in 1930 that there were certain regions in interstellar space where the light from distant stars was dimmed and scattered in all directions came as a big shock to astronomers.

The shock lay in the fact that, if there was some kind of haze in interstellar space which had the effect of dimming the light from distant stars or rendered them invisible, then previous calculations of star distances were wrong. Star distances are largely computed by the brightness of a star in relation to size.

Nevertheless, astronomers had to admit that there is something in interstellar space.

It has been found that for every 2000 light years of its travel through certain regions of our galaxy, starlight loses almost half its energy by absorption and scattering.

NO EMPTINESS

The result of this is that, even with our most powerful instruments, we cannot see the centre of our own Milky Way system which is 25,000 light years away. A mere hop step and a jump in terms of modern telescopes. We can only see a distance of about 6000 light years.

Now this disturbing fact has already forced astronomers to review their estimates of the distances of certain stars. These have in some cases been doubled.

Space between the stars is therefore not empty. What then is in it?

Recent observations seem to indicate that it is smoke and dust. The sizes of particles may be estimated by the color of the light passing through clouds or the color of the scattered light.

Such measurements have shown that the dust in interstellar clouds

(Continued on page 19)

acos

A COMPLETE RANGE

CRYSTAL MICROPHONES
MICROPHONE INSERTS

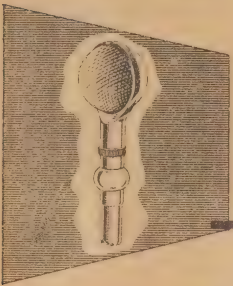
FOR EVERY PURPOSE

DESK or HAND MICROPHONE, MIC36

This Microphone is ideal for home recording and public address, etc. Response unexcelled for its size and price. The performance is not affected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. Recommended load resistance not less than 1 megohm, dependent on low frequency response. Can be supplied complete with switch and floor stand adaptor, as required, at a small extra cost. **PRICE, £6/18/6.**

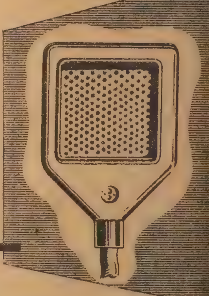
TABLE or STAND MICROPHONE, MIC22

This omni-directional Microphone is robust in construction, with a pleasing appearance. Vibration, shock or low frequency wind noise will not affect the performance. The low frequency cut-off is dependent on the load resistance. The cut-off is given by the equation, F = 80 divided by R, where F = c.p.s., R = megohms. An adaptor (floor mounting) is available at low extra cost. **PRICE, £9/18/6.**



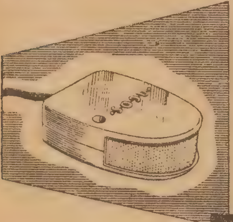
HIGH-QUALITY MICROPHONE, MIC16

This Microphone incorporates the world-famous floating crystal sound cell construction. Its fine performance is not affected by vibration or shock. The fidelity is not impaired by low frequency noise. **PRICE, £24/19/6.**



LAPEL MICROPHONE, MIC28

Designed to give freedom of movement, this Microphone is small and non-directional. Housed in a soft, moulded-rubber case, which gives protection against shock, it is provided with a pin at the rear of the case for pinning to the lapel. **PRICE, £5/19/6.**

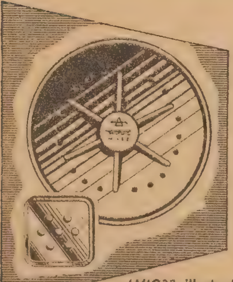


GENERAL PURPOSE, MIC35

The MIC35, is ideal for amateur transmitters, public address, etc. Housed in an attractive die-cast case, it features a high sensitivity and substanially flat characteristics. Provided with a built-in shunt resistance of 2 megohms, it will, when connected to the grid of the input valve, give a substantially flat response from 50 to 5,000 c.p.s. **PRICE, £2/15/-.**

HAND or DESK MICROPHONE, MIC33

This Microphone has been designed for the high quality public address and home recording field. High sensitivity and flat characteristics are obtained by a specially designed acoustic filter. Housed in an attractive plastic case with an unexcelled response for its size and price. Unaffected by vibration, shock or low frequency wind noise. Omni-directional frequency response substantially flat from 30 to 7,000 c.p.s. **PRICE, £6/18/6.**



(MIC32 illustrated)
(MIC23 illustrated)

CRYSTAL MICROPHONE INSERTS

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INDUSTRY NEARS AUTOMATIC AGE

(Continued from Page 7)

BMC in England is striving to lead the industry with productive capacity, using automation as the spear point of their drive.

Here in Australia the BMC subsidiary company is planning on using transfer machines at the Victoria Park plant to assist in the ow cost production of Australian-built engines.

The first firm to actually use he name "automation", as far as ve can determine, was the Ford Motor Company who used the word n 1948

BIG BUSINESS

The first "giant brains" were also American. They were built by the Bell Telephone Laboratories just rior to the last war during their esearch on dial telephones. Today here are about 38 giant electronic alculators in the world and many housand small ones, all of which an perform prodigious feats of mathematics and calculations in the winkling of an eye.

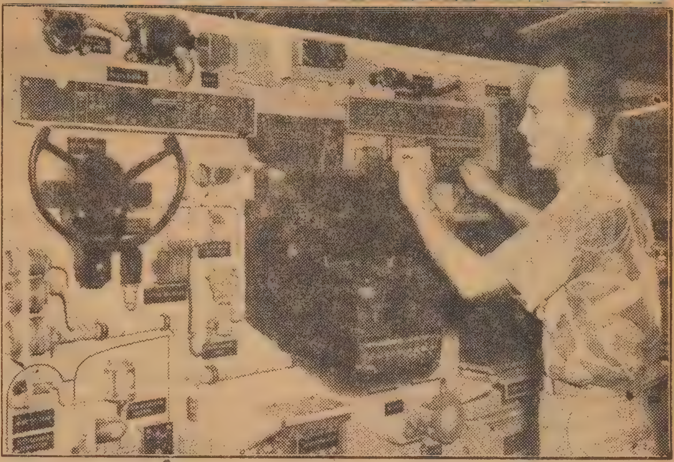
Now automation is big business. Not only is it big, but it is exensive business. Only the very largest concern can afford to even hink in terms of full scale automation. Recently, a machine designed for milling the ends of utomobile cylinder blocks sold for 9,000 dollars—and it is a small machine by current standards. Just ver 40 years ago, the four flat urfaces of a cyinder head were machined at the rate of 108 an hour. ne hundred and sixty-two machines were required for the operation and their total cost was 43,000 dollars. These machines roduced the cylinder heads at a irect wage of 40 cents each. Today e same operation is carried out y one automated machine costing 30,000 dollars—at a wage rate of nder 4 cents a piece.

Like all other good things, automation does not come cheaply. It will hasten the trend toward big ombines, but it will also provide great deal of work for small ompanies who can economically roduce the millions of parts required to produce automated quipment.

FFECT ON JOBS

These facts all lead to one poignat question. Will "mechanical brains" grab our jobs? Here are a few facts which will help you t make up your own mind on tis question. Dial telephones were itroduced in America just before World War II. Yet between 1940 and 1950 the number of employees in the telephone industry icreased by 159,000—or 79 pc. Despite fabulous machines now being istalled in large offices all over North America, the figures show at the need for auditors and clerks is growing daily. In the automotive industry there has been a vigorous growth of automation, yet the number of employees during the fast 14 years has doubled, while the number of mechanics and service men increased by 75 pc. Why? Because more people were able to buy motor cars.

ELECTRICAL TEST FOR AIRCRAFT



LOADED PANEL—The complete electrical system of a P2V Neptune patrol bomber is being put into action on this mobile training unit board as a Lockheed technician "pulls the throttle". Hooked up and working, the panel even has a special device on the back to simulate all in-flight conditions. This and other aircraft systems boards are used by the military to train mechanics and technicians.

NEW THOUGHTS ON OUTER SPACE

(Continued from Page 17)

is only 1 or 2 pc of the weight of the cloud. The rest is gas.

Where the dust comes from and what it is creates a problem for astronomers in the Geophysical Year. The effects of the discovery has already had far reaching effects.

There is another little problem which is constantly being probed by scientists. It is the problem of the Zodiacal light.

ZODIACAL LIGHT

This is a phenomenon which is visible to the naked eye as a faint band of haze which appears as an arch from the western horizon shortly after sunset in the spring. In the autumn it also appears in the eastern horizon just before sunrise.

At midnight that part of this belt of haze immediately overhead glows more brightly and is called the counterglow.

It was at first thought that this light was a cloud of meteoric particles which surrounded the sun. Another theory gave the reason as refracted sunlight.

A more recent theory envisages the light as being caused by the electrification of air particles by lutra violet radiation from the sun.

The theory is stated by Gray as follows:—

Air particles are originally neutral or unsmashed molecules. Like all gas molecules they are perpetually on the move, and as the sun's rays heat the atmosphere the particles move faster and ever upward. Many of the particles acquire speeds which carry them to heights of up to 50,000 miles above the earth. By the time they have reached this height, the ultra-violet rays have ionised the molecules. Being now charged fragments they are trapped by the earth's magnetic field and their outward flight is checked by the attractive forces of our terrestrial magnet. The combined forces of gravitation and the pressure of light causes the particles to drift horizontally eastward and westward around the earth and finally under the pressure of sunlight to trail off in the direction away from the sun.

Thus on the day side of the earth the particles never rise higher than about 50,000 miles, but on the night side they trail off into space and the sunlight stimulates them to fluoresce.

Hence the particles are visible and this stream of visibility may extend into the earth's night shadow for as far as a million miles.

Thus the Zodiacal light is a distended cloud of electrified fluorescing particles arching up as a band of haze pointing away from the sunken sun after sunset and before sunrise.

At midnight the distended cloud is directly above us appearing at the zenith as the counterglow, which is the centre of the cone of the zodiacal light seen from below.

If this theory is true, the earth would appear from outer space as having a comet-like tail of electrified particles a million miles long. It would be a magnificent and spectacular sight which space travellers of the future might yet see if the theory is valid.

The highly complex nature of our own solar system within our own galaxy, the Milky Way, is enough to tax the resources of astronomers and astrophysicists for many years to come.

Modern techniques, whilst resolving some of the problems, add further confusion by uncovering inaccuracies and faults in previous theories. This necessitates further revision until more new techniques are evolved and the process goes on and on to provide man with the stimulus for an endless search for truth.

The WARBURTON FRANKI Page

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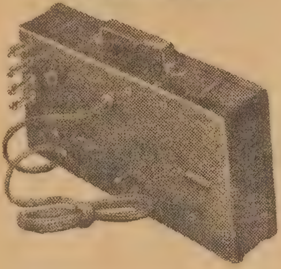

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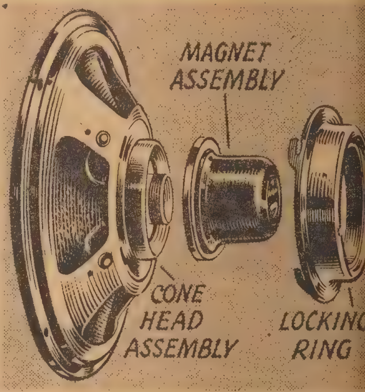

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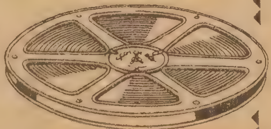

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Technical Review

TRANSISTOR PREAMP. EXTENDS CRYSTAL MIC. LINES

In this article from "Radio Electronics", the author describes a method of overcoming line losses &c, by adding a transistor preamplifier to a crystal microphone.

WHEN fed from this preamplifier a very inexpensive two-wire audio cable or 300-ohm lead-in will carry the signal with little loss (Fig. 1). We have used over 250 feet of transmission line successfully and there is no reason why lengths up to 1000 feet cannot be used.

For our needs the terminating unit was a tape recorder, though it could just as well be the phono input of a high-fidelity installation, radio, television, public address system, etc.

In our particular application we used the transistor amplifier and tape recorder for recording wild bird songs. The amplifier was mounted in a large colander that can be purchased wherever kitchen utensils are sold. Thus the pickup characteristic was more directional and background noises were reduced.

In addition to a hole drilled in the colander to mount the pre-amp, two more were made to insert a small U bolt so the unit could be fastened to a mast, pole, tree limb, etc.

GROUNDED EMITTER

The transistor amplifier (Fig. 2) is a basic grounded-emitter circuit with a stabilising emitter resistor. The transistor stage operates at a medium input impedance to provide a suitable termination for a small crystal microphone cartridge. The degeneration resistor also minimises overload when the sound level is high. The crystal microphone cartridge is cemented to one side of the case.

All components, including battery and transistor, are mounted firmly to permit rough handling in the field. Rugged binding posts permit a firm attachment of the audio line to withstand considerable tugging.

The output impedance of the grounded-emitter transistor stage is high enough to provide good gain and low enough to permit driving a long length of cable without serious high-audio-frequency loss.

In our application a very inexpensive and, therefore, expendable audio cable is used. After one day of wood tangles and dampness we prefer to discard the line and start with new line on the next field trip. It is easier than trying to protect high-quality shielded line.

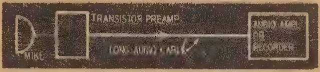

Fig. 1—Cable and terminal units.

Lack of shielding does give us hum pickup at times in the vicinity of power lines. When hum level is high, we drive a 3-foot metal stake into the ground (Fig. 3). As short a lead as possible is then run between the ground terminal of the transistor amplifier and the metal stake.

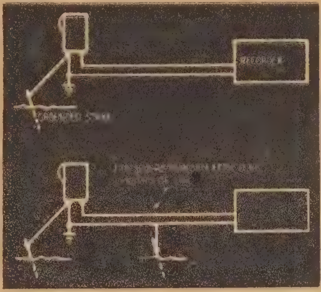

Fig. 3—Connections for hum reduction.

For a severe case of hum an intermediate stake can be used and connected to the ground wire of the cable. When used indoors, hum can be reduced by finding a good grounding spot as near the amplifier as possible.

With the availability of lower-priced transistor transformers, it is economical to use low-impedance transformer coupling (Fig. 4). This helps minimise hum and noise pickup by the long length of line between the remote amplifier and the input of the amplifier or recorder.

A remote amplifier has numerous applications. It can be used for recording all types of sounds. It is excellent for picking up crowd noises, traffic sounds, aircraft, animals, locomotives, &c.

If you are trying to build up a library of sounds, a simple remote amplifier is most helpful. A transistorised unit permits you to position your microphone at a site inconvenient to an AC outlet such as in woods, open fields, athletic fields and rooftops.

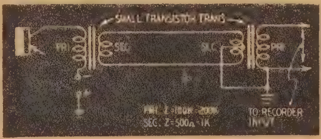

Fig. 4—Using transformer Coupling.

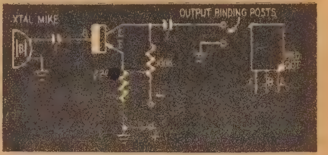

Fig. 2—Schematic of transistor preamp.

There are also many listening-in applications for a remote transistor amplifier. In this service the transistor preamp can be used to supply a signal to any type radio or television set with a phono input.

Thus it can be used as a baby sitter, intruder-warning device, one-way intercom, etc. It is convenient because it can be moved about, indoors or outdoors, without regard to nearness of an AC outlet. Long lengths of line can be attached, permitting wide separation between the microphone and listening receiver.

The transistor unit can serve as a remote microphone for a high-fidelity installation or public-address system. In PA work two or three of these units can feed signals to an audio mixer. Thus, a number of widely separated pickup points can supply information to a single audio control centre. Remote pickup points can be planned and shifted without regard to separation.

TESTING

The transistor preamp can be tested by connecting its output to the vertical input of an oscilloscope. If you whistle a reasonably pure tone into the microphone, you can observe its sinusoidal makeup on the scope screen. This waveform should not be distorted until you whistle loudly very close to the microphone. Then the waveform will flatten off, indicating an overload of the transistor amplifier.

If the amount of overload is too great for close-in use of the microphone, it can be reduced by increasing the value of the emitter resistor. For our application we desired the utmost sensitivity, realising the sounds to be collected would in general be well separated from the microphone.

(Note: A grounded collector circuit may be preferable in many locations. Gain may be lower but impedance relationships should be more favorable.—Ed., R. T. & H.)

Another Milestone in the Search for

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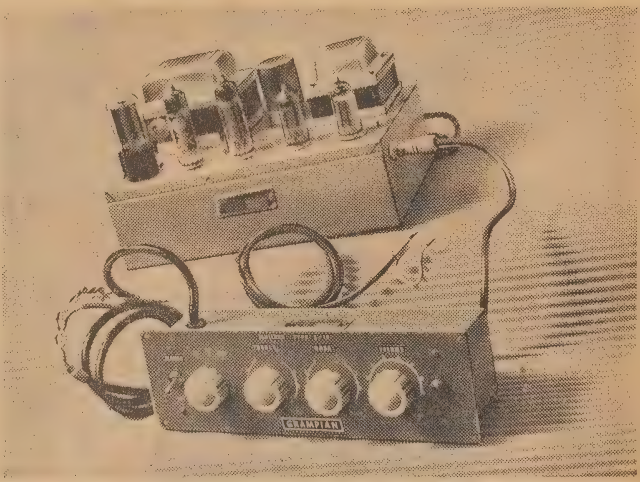

ECONOMY

MULLARD

This amplifier, based on the well-known "Mullard 5-10", incorporates some improvements on the original layout. It is intended for use with crystal pickups and fully complies with the circuit specification. The separate control unit which can be fitted in the top or front of the cabinet has a mains on/off switch, pilot lamp, volume control, bass and treble tone controls and three-position switch giving the necessary compensation for L.P. ar 78 r.p.m. records or radio input. The circuit is a thre stage one with 26db of negative feedback taken from th output to input stage. The high gain input stage, EF8 is directly coupled to the phase splitter, ECC83, whic feeds the output stage employing two pentodes in pusl pull, 2-EL84. H.T. supply is by a GZ30 rectifier valv

TECHNICAL DATA

Power Ouput, rated	10 watts
Power Output, maximum	12-13 watts
Total Harmonic Distortion	Less than 0.4 pc at 40c/s Less than 0.2 pc at 400c/s Less than 0.3 pc at 2.000 c/s
Hum and Noise	—73db relative to 10 watts
Frequency Response	plus or minus 0.5db 10c/s to 20,000 c/s
Input impedance, pickup	1 megohm
Sensitivity, pickup	600 m.v. to give max. output
Sensitivity, radio	350 m.v. to give max. output
Treble tone control continuously variable	—10 to +10 db at 10,000 c
Bass tone control continuously variable	—5 db to +11 db at 20 c
Output impedance	15 or 4 ohr
Mains supply	200-240 volts A.C. 50 c
Mains consumption	72 wat
Supply available to radio unit	H.T. 250 volts 40 m. am Heaters 6.3 volts 3 am
Finish	Old Gold Hamm

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ROTATING TAPE HEAD REVEALS FAULTS IN RECORDING

Imperfections in a tape recording are difficult to analyse on ordinary machines, where the tape travels past a stationary head. A new device, developed by the US National Bureau of Standards, allows a short length of tape to be examined in detail, with a view to establishing whether an unusual signal phenomenon is genuine or due to a mechanical fault in the recording tape.

THE device also makes possible a detailed, progressive study of recorded phenomenon along the length of a tape.

It is invaluable for examining pulse data from digital computers but the principle is obviously applicable to any kind of recording.

The instrument makes use of a reading head mounted on a rapidly rotating drum so that the head is in contact with the tape for a part of each revolution. Since the tape is held stationary, the head reads exactly the same set of signals once each revolution, and the playback can be displayed continuously on an oscilloscope and observed as long as desired.

TAPE OR WIRE

In addition to providing a means for closely examining the playback signals from a specific portion of the tape, the reader can be used to scan through and edit a complete tape. The observer can easily locate any defective signals. Interchangeable parts provide a means for examining several different sizes of magnetic tape or wire.

In the development of magnetic tape and wire equipment for external pulse storage in electronic digital computer systems, one of the primary considerations has been reliability of operation. An important factor is the condition of the tape surface itself.

Errors can be caused by tape faults such as "holes" and raised spots in the magnetic surface, or creases in the tape. Very often the loss of several pulses or the gain of a single pulse may be caused by a flaw that is too small to be visible to the unaided eye.

Conventional means of tape reading are not suitable for locating errors, since the tape is moved continuously past a stationary head. In investigating tape for faults it is desirable to read a small specific portion of the tape over and over at a rapid rate, and to display on an oscilloscope a steady picture of the playback signals.

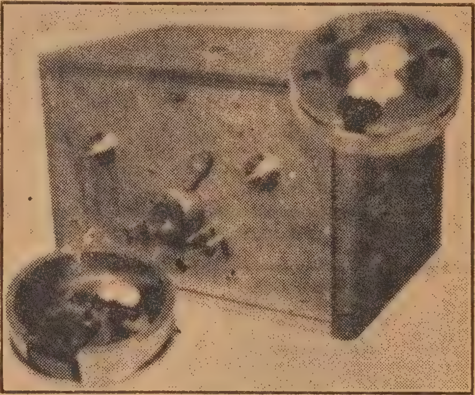
SOLVES THE PROBLEM

The rotating head reading device developed at NBS provides such a repetitive method for examining tape. Once faults are located, they can be removed or else avoided in the future, thus increasing the reliability of the tape.

For convenience, the tape reader is mounted on a vertical panel. Near the two upper corners are the shafts on which the tape reels are mounted. Although tape must be reeled manually on the NBS model, a motor drive or stepping mechanism could easily be attached. The idler shafts are friction loaded to maintain the proper tension on the tape for reading as the tape is reeled along.

At the lower centre of the panel is the rotating drum on which the reading head is mounted. The drum is 2 7-8in in diameter and rotates at 10 rps. This is equivalent to a tape speed of 90in/sec. The drum is made in two sections. The reading head is mounted on one section and has a groove or track machined around the periphery in which the tape or wire rides. This section is easily removed, and other similar sections substituted for different sizes of tape or wire.

The section of the drum nearest the panel is fastened to the drive shaft and is not ordinarily removed. This section is cup-shaped with the open side toward the panel. A photoelectric cell is mounted on the panel, inside the cup-shaped section, close to the periphery of the drum. A small aperture in the drum wall makes it possible to focus an externally mounted lamp on the photocell when the drum is in the proper position.



Close examination of a short section of magnetic tape or wire is possible with this device: It utilises a drum (centre of panel) with a reading head which is rotated repetitively over a short segment of tape. The same set of signals are read repetitively and may be displayed continuously on an oscilloscope. Inserts show rotating heads for tape (lower left) and wire (upper right).

Each time the hole in the drum wall passes the light source, the light strikes the photocell and causes a small output pulse from the cell. The pulse is applied to a cathode follower which in turn triggers the oscilloscope sweep. The aperture in the drum wall is so located that the trigger pulse occurs just before the reading head makes contact with the tape, so that the oscilloscope sweep always begins slightly before the first pulse is sensed by the head. It is this timing system that provides a steady picture of the repeated playback signals on the oscilloscope screen.

Since the reading head is mounted on a revolving drum, electrical connections must be made through slip-rings and brushes.

On the front of the panel are four grooved studs that guide the tape as it enters and leaves the reels and the rotating drum. Rubber shoes pressing firmly against the studs prevent the tape from creeping while being scanned.

Trials of the equipment in the laboratory prove its usefulness in locating tape flaws and in reading recorded pulses. The playback signal on the oscilloscope screen shifts such a small amount that photographs taken with an exposure time of 15sec reveal no evidence of blurring.

By expanding the oscillosope sweep, it is possible to read a computer word simply by recognising the value of each recorded digital pulse. The rotating head has been used in this way to compare information on a magnetic wire with the paper tape from which it was recorded.

In addition to being an effective and useful means of investigating magnetic recording phenomena, the rotating-head type of the reader could also be used as a means for transcribing information directly from the keyboard to the magnetic tape.

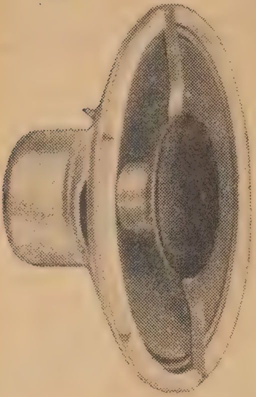
It would be most convenient to use a multichannel tape together with some provision for advancing it in short, precise steps. Each time a key on the keyboard is pressed, the corresponding character in coded form is set up in an electronic register. Then at a specific point of the rotating drum revolution, the contents are recorded on the tape in parallel form.

On the next revolution of the drum, the character just recorded is compared with the character stored in the register. If the two agree, the tape advances a small distance.

If the two characters do not agree, the tape advance mechanism is locked out, and an indicator flashes.

In this way, an operator could transcribe his problem directly from his manuscript to a magnetic tape.

WORLD'S FINEST
Peerless SPEAKERS



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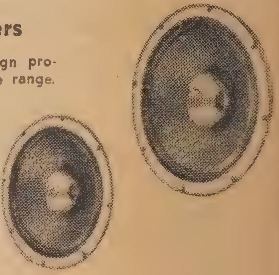
Power Handling Capacity, 10 watts. Input Impedance, 3.2 ohm
Frequency Range, 40 to 15,000 cycles.

Peerless High-Fidelity Dual Cone Speakers



(Far right:) 12in. Dual Cone Speaker with frequency range from 45-1400 cycles. Design provides High-Fidelity reproduction at moderate cost with velvet smoothness over the entire range.

Power Handling Capacity, 8 watts. Input Impedance, 5 ohms.
Frequency Range, 45 to 14,000 cycles.

●

(Right:) 8in. High-Fidelity Dual Cone with frequency response flat 55-16,000 cycles. This is one of the most versatile Loudspeakers in the world and is now in wide use in multiple Loudspeaker systems and small cabinet enclosures throughout Europe and America.

Power Handling Capacity, 6 watts. Input Impedance, 5 ohms.
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NEW TYPE COLOR TELEVISION TUBE MAY BE SIMPLER

A new color TV picture tube that may have advantages over both the now almost universal shadow-mask type and its only present rival, the one-gun Lawrence tube, is in the developmental stage. Samples were demonstrated by the General Electric Co.

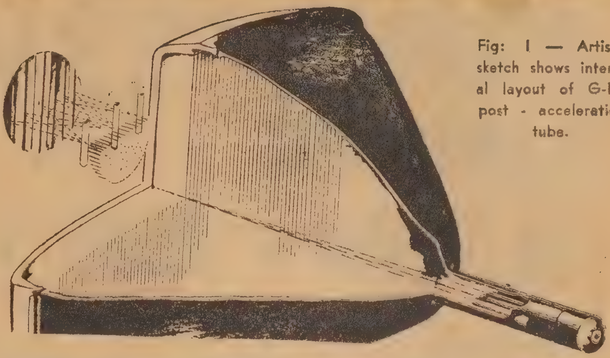

Fig: 1 — Artist's sketch shows internal layout of G-E's post - acceleration tube.

Problems of mass production are till to be straightened out, but the ompany believes the tube may be n the market in about a year.

The new tube has three guns — rranged horizontally in a straight ne (Fig. 1) rather than in a riangle—and a vertical grille near he screen.

The grille looks something like he grid of the Lawrence tube—hough in action it resembles RCA's hadow mask—and forms an elecron-optical lens system that lets ore than 90 pc of the electrons hrough to the screen instead of e approximate 15 pc that get rough the shadow mask.

It also performs some of the funcions of the Lawrence tube's grid, ut differs distinctly in that the otential on it is fixed and no ynamic voltages are applied. All ires are at the same potential.

COLOR STRIPES

The faceplate of the tube is made p of vertical color stripes, about 12in wide in one of the experiental models shown. About 0.8in ehind it, the grille—consisting of ires approximately .003in in diaeter, spaced about .035in apart— fixed.

The phosphor screen is kept at a oltage of 25,000, the grille at 3,000. The voltage on the accelerting anodes of the electron guns is 590. Thus the beam is accelerated fter deflection and is referred to as post-acceleration tube.

Because of the difference in potenal between the screen and the wire rille, the field between is so shaped to form an electron—optical lens ystem that bends as well as ccelerates the electron beams.

An electron tends to go in the irection of the highest potential— cross the lines of equal potential approximately a right angle. hus, electrons that enter the grille a right angle travel straight head. Electrons that enter the rille region at a slight angle travel a parabolic path toward the phoshor face.

As seen in Figs. 2 and 3, a beam ming straight down the tube will -in the section shown—be focused a narrow strip in the middle of e vertical stripe halfway between e grid wires.

A beam coming in from the left -represented by a single ray in ig. 2—will, in trying to move in e direction of greatest increase in ltage, be focused toward the ght, and the one from the right ward the left.

Focusing action is an important ctor in preserving color purity. he beam, which may be as much .035in wide, is focused down to about .005in in the centre of a .012in stripe.

The progress of the beam across the screen is interesting. As the green beam—for example—continues toward the right in Fig. 3, part of it falls beyond the right grille wire. This portion is immediately deflected toward the centre of the next green stripe, and as the beam continues to sweep it becomes stronger on that stripe as it becomes fainter on the preceding one.

An important advantage is that the tube requires less deflection voltage than one in which the beam is accelerated by the full screen voltage. The beam leaves the electron gun at 6.5 kv and, instead of being accelerated, sees ahead of it a slightly lower voltage—that of the grille.

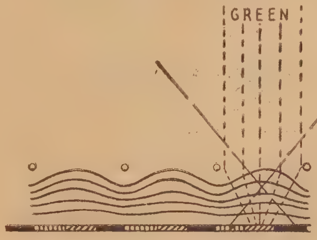

Fig. 2—Lines of equal potential make a sine-wave type pattern that flattens out as the screen is approached

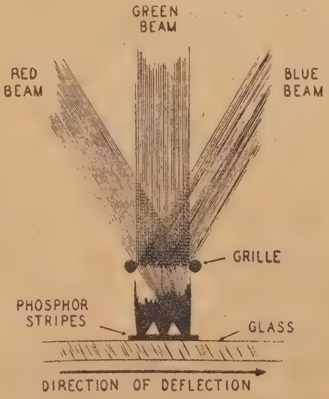

Fig. 3—Electron beams enter grille.

Thus the beam is much less "stiff" since the electrons are moving at relatively low velocity and need less power to deflect. The yoke is therefore much smaller than that required for present color tubes, using only about 40 pc as much copper.

The convergence problem is simplified by the in-line position of the guns. The central green beam is not controlled, and the two outside beams are made to converge with it. It is necessary only to move the two outside beams horizontally.

The greatest advantage of the new tube is brightness, which G-E engineers claim to be at least six times that of the shadow-mask type. Developmental models of the tube were demonstrated under conditions of normal night-viewing illumination (7 foot-lamberts), home daytime viewing (up to 50 foot-lamberts) and under illumination similar to the high-intensity lighting of the dealer's floor.

Under both the latter conditions the postacceleration tube showed up well, while the picture on the shadow-mask tube tended to wash out.

The tube's brightness is accompanied by a disadvantage. Secondary electrons from the grille and those released from the screen itself strike the screen in a random manner and cause a slight white background and consequent loss of contrast. This result is most noticeable in a darkened room and is not as apparent under normal or bright lighting.

The earth's magnetic field has been a factor in reducing purity and various means, including heavy mu-metal shields, purity coils or assemblies of permanent magnets around the tube face have been used to counteract it.

Because of the vertical stripe pattern of this tube, the horizontal component of the Earth's magnetic field—which would cause the beam to move up or down—has no effect on color purity. Its vertical component, which would move the beam horizontally, is fairly constant over the United States and can be compensated for in the design of the equipment. Thus there is no need for heavy and expensive magnetic shielding. (Radio Electronics.)

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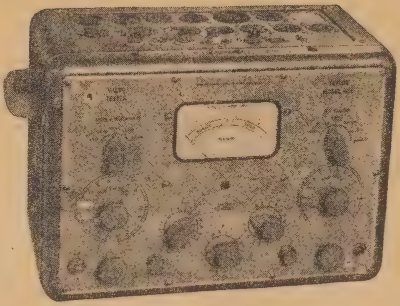

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Dimensions: 4-7/8 x 3-1/8 x 1-15/16in.
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Oscilloscope Model 31A

Oscilloscope Model 31A

This instrument is designed primarily to meet the requirements of Television and Radio Service work, but is also suitable for use as a general purpose instrument. Tube-Cossor 88J (Blue), 4in dia., electrostatic deflection, E.H.T. 1,200v, Cathode to final anode. Input sensitivity 12.5v R.M.S. per inch; input resistance approx. 5 Megohms. Y Amplifier Frequency response 10 c/s to over 6 Mc/s within plus ½-3db.

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SOLE AUSTRALIAN AGENTS

SCIENCE NOTES BY PROF. A. M. LOW

Have you noticed that in all good games and amusements science now takes a vital part? Golf balls are examined for ballistic properties, high-speed cine-cameras record various strokes and wrist positions, and the most technical methods imaginable are used to manufacture billiard tables or to record the winner of a dog race.

THE new revolving winning post which only causes a slight blur to the eye but shows an exact position under the eye of a camera, is an example, but if it ever slows down during use I feel that some onlookers may think of the story of the man who stepped upon one of the new spring ballroom floors after dinner and was heard to mutter, "Does it, or am I?"

The latest joke vendor on the music-hall stage will soon be using what I might call a "personal" talker. He will affix a small loudspeaker at the focal point of a parabolic sound mirror and then, pointing it to the desired group in the audience, will tell the story.

FINDING ECHOES

An almost exactly similar method is used to find where echoes occur in buildings used for musical entertainment. Noises are directed at different spots and the direction of the axis of the mirror noted so that part of the ceiling or a section of some particular wall may be treated by means of sound-absorbing plaster.

Has it occurred to you that there is now in existence an "atomic" motor? Have you not seen in the window of a chemist's shop a Crooke's radiometer?

It is merely four little vanes, one side of each being blackened and the other bright. The sunlight falls upon them and, as there is a little air in the bulb, heat is usefully reflected from the bright side and absorbed by the black and round goes the motor.

Obviously, black absorbs heat or gives it out whereas bright objects merely reflect like reflectors in an electric fire without themselves getting too hot.

THE WATER IMP

Just as a few million photo-electric cells might theoretically work an electric railway so a few more million radiometers might drive a car. It is almost an atomic motor n one sense but has very little resemblance to the machine of the future.

If ever you have to amuse the younger members of the family and want to lead them toward the beauty of model making with a useful purpose, try a modernised "water imp".

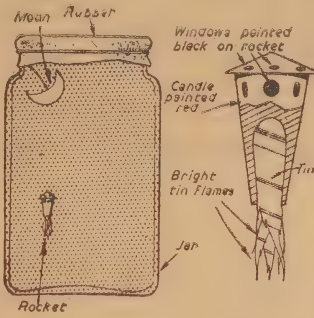
It is very simple. Cut about 1½in of candle into the shape of the traditional space ship and hollow it out as in the sketch. Stick a flame-ike piece of thin tin underneath nd put it into a jar full of water, weighting the candle with pins inside until it only just floats.

Fill the jar to the top and stretch over it a piece of rubber sheet from n old inner tube. As you press, the air in the jar is compressed, the displacement is reduced and down goes the ship; it rises again when your finger is taken from the rubber seal.

A quarter moon in the top of the jar helps this toy to please everyone.

Until comparatively recent times, everyone did not hesitate to drink water from streams.

Now we have discovered queer things through microscopes and we know that a drop of water in a pond looks like a jungle with horrible creatures dashing about all day.



The space ship "Water Imp."

The electron microscope extends this range and it can even show an unfilterable virus in shadow form. It may help us to find the cause of some of the ordinary colds.

Germs are quite clever things; they may even have sex differences.

Moustaches, we all know, used to filter things from streams, but we have progressed a little and use pack filters to remove the smallest particle. Electrical methods can destroy germ life which is bad for us. I hope that the good germs stay behind, as is alleged in the various treatments of milk.

Nowadays water is quite a complicated affair. Mountain streams need softening to avoid waste of soap and to make it usable for washing; the burbling river probably contains dirt from animals so that boiling or filtering is essential, while even aeration might be considered before the water reaches our table.

The latest method of water softening is by use of certain strange minerals called zoolites which are found in natural form or can be made synthetically.

Zoolites have the very useful property of being able to take out the lime and magnesium from water that is passed over them and replace those chemicals by harmless sodium compounds.

By such a method thousands of pounds a year can be saved in industrial plants, for the cost of the water softening process is small in comparison.

DICTA-WRITER

I have noticed a reference to a machine which actually types what is spoken to it, and, as this would seem to outpace the beautiful dictaphone which I have used with thankfulness for 30 years, I want to cast doubts upon the practicability of this stenographic marvel.

In the first place no two people speak alike, and while it is not difficult to arrange two diaphragms of which one responds to the word "yes" and the other to "no" so that a robot will do what it is told in answer to a few simple queries, I do not credit that the system is, as yet, capable of much extension.

How could anyone adjust any mechanical apparatus so accurately? Let alone keep it adjusted in order that it might type the same word when spoken to by a Scotsman, an Irishman, an American or myself with a bad cold.

The "typophone", as I have nicknamed it, will not be possible, or so I think, until phonetic speech and perfect mechanism replaces our vocal arrangements.

MECHANISATION

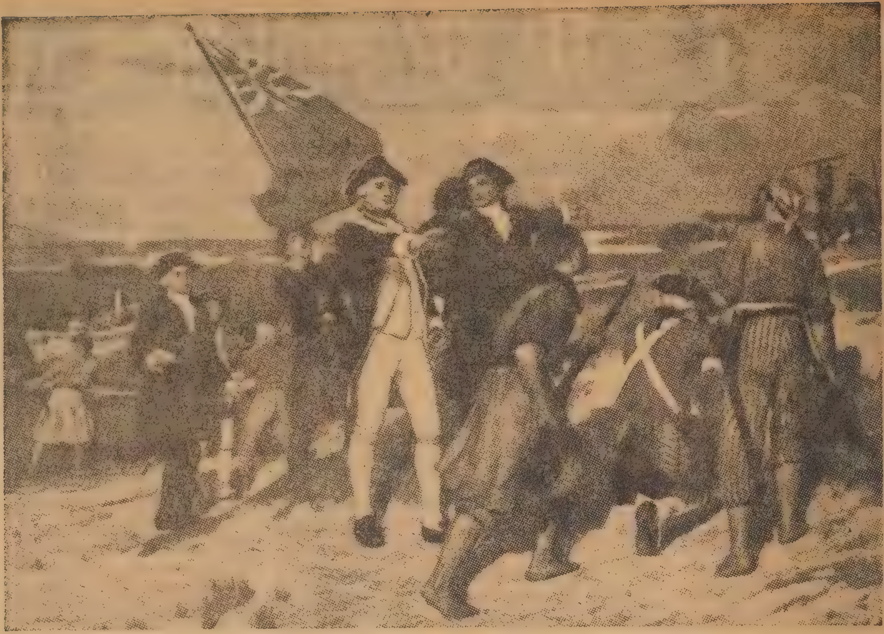
I have always thought that speech was a nuisance and the necessarily complex apparatus of rubber tubes, glycerine, lubricants, balloons and pressure-control valves which were so cleverly used by Sir Richard Paget when he manufactured such simple words as "Mamma" or "Papa" most adequately supports my theory.

The day when most of our bodily parts can be mechanised will not be for many, many years. I believe it will come, but I hope we shall think more clearly at the same time.

* * *

A NEW SUB-ATOMIC PARTICLE

A NEW sub-atomic particle has been discovered by scientists working at the University of California. The new particle, called an antiproton, has the same mass as a proton, but carries a negative, rather than a positive charge. Its existence has been suspected for the past 25 years but practical proof of it has only been possible recently, with the aid of the new Bevatron accelerator at the university.



"THE LANDING OF CAPTAIN COOK" by Philip Fox. By Courtesy of the NATIONAL GALLERY OF VICTORIA.

"Captain Cook Discovers New Continent"

RADIO AUSTRALIA flashes daily news around the world. Jocelyn Terry is shown here broadcasting messages from home to Australians in lonely outposts in Antarctica.

This was stirring news to the world of 1770, but it was three months before King George III of England heard about it.

Today, news like this would be flashed round the world by radio.

In Australia from Cape York to Hobart, from Brisbane to Perth, radio listeners hear immediately about any important national event.

Research Helps Radio Progress

The SHELL Company employs 5,000 research scientists. Some of the work they have done for radio has improved various parts of electrical equipment such as enamelled wires, insulating materials and resins which effectively seal radio condensers.

If it were not for these important things which are used in your radio, the set would not stay in such good order that you can be sure of being able to hear every item of news in which you are interested.

Shell shares in the advancement of radio technical equipment for the benefit of listeners.

NEWS AND VIEWS OF THE MONTH

"Sirius" tabbed

SCIENTISTS at the University of California have, with the aid of Univac, an electronic computer, been able to examine the evolution of Sirius. Without the aid of this computer, the task could not have been undertaken because none of the scientists would have lived long enough to complete the calculations involved.

"Gold-film" glass

A NEW advance in de-icing techniques for aircraft is the introduction of gold-film glass. The windscreens of high-flying aircraft have a transparent gold film deposited on the surface, which is electrically heated to prevent the formation of ice.

Aluminium bearings

WHEN journal bearings on the wheels of railway rolling stock become hot, they result in hotboxes which increase the operating cost of railways. Now an aluminium bearing has been developed which possesses several advantages over the bronze type. It is about one-third the weight and does not produce what engineers call copper penetration, which reduces the strength of steel axles to breaking point.

TV for Games

THE Australian Broadcasting Commission expects to have television working by November—in time for the Olympic Games.

This has been stated by the assistant general manager of the ABC (Mr. A. N. Finlay).

He said the only possible delay could come through a hold-up in equipment.

He did not expect such a hold-up.

Mr. Duckmanton, the ABC's television specialist, has said that the ABC would use Australian talent on TV as in radio, but would also use some overseas material.

Mr. Duckmanton has just completed a five-month tour of Britain, the Continent, and the United States.

Church TV school

CHURCHES in America have set up a college where ministers can learn television techniques.

A visiting churchman said recently that Australia would find it useful to open a similar school.

He is Dr. Eugene Carson Blake, president of the National Council of Churches in America.

He said the National Council of Churches in America presented television programs on 90 stations to more than 3-million viewers.

A preaching service was the least effective way of presenting religion on TV.

"People who don't normally go to church just turn off a preaching service," he said.

"The minister's job is to pull the program together and to try to get one idea across during a half-hour program.

"It's ineffective to try to say too much."

More TV sets

SALES of television receivers rose by six pc to 1,335,000 in 1955, according to a London newspaper report.

At the same time, sales of radio receivers fell by 14 pc to 1,048,000.

Australian uranium

PHYSICISTS at New South Wales University of Technology are producing pure uranium metal for the first time in Australia.

They already have produced about 10oz of the metal.

"We produced a piece of pure uranium metal about the size of a nobbler of whisky," Professor Rupert Myers (Professor of Metallurgy at the university) said recently.

"We used concentrates of crude uranium compounds the South Aus-

POPULAR SCIENCE QUIZ

Q. Will electricity spark across adjacent plates easier in a vacuum than in air?

A. That depends on the degree of vacuum. Starting from the usual atmospheric air pressure, if the pressure inside a discharge chamber is reduced, the voltage at which sparking will occur becomes smaller in an almost linear fashion until it reaches a minimum at a fairly low pressure. This minimum is small compared with the sparking voltage at atmospheric pressure.

If the pressure is further reduced, the voltage which must be applied for sparking increases in a spectacular manner. At very low pressures, very high voltages are required to cause a breakdown. It is partly for this reason that high voltage RF capacitors are sometimes sealed under vacuum.

Experimental investigations have shown that the sparking potential is in actual fact a function of the product of pressure and distance between the electrodes, and that this curve has a minimum where the product is small. That is, the sparking potential increases when the product (p x d) is increased or reduced in relation to the minimum.

A striking experiment to illustrate this can be conducted by setting up a tube so that there are two paths through which the discharge can take place, a short one and a long one. At high gas pressures the discharge takes the shorter of the two paths so as to reduce p xd. However, at low pressures p x d may be smaller than the minimum value and the discharge will actually take the longer path, thus increasing the value of p x d and decreasing the sparking potential.

For air, the minimum sparking voltage is about 300 volts when p x d is equal to 6 approx. In this case p is expressed in millimetres of mercury and d is in centimetres. Normal atmospheric pressure is about 760 millimetres.

Q. What are cosmic rays?

A. Not all is known about cosmic rays and research into their behavior is being undertaken in many countries, including Australia. Their origin is outer space and from their behavior in the earth's magnetic field, scientists are certain that at least some of the cosmic rays are, in fact, high-speed positively charged particles with characteristics similar to protons.

The interesting thing about cosmic rays is the colossal energy associated with such a minute particle.

Scientists, for convenience, use the electron volt as a unit of energy. This is simply the amount of energy involved when an electron accelerates through a potential difference of 1 volt.

The best particle accelerating machines are only able to attain energies of the orders of hundreds of millions of electron volts while the energy level of cosmic particles, even after they have passed through the earth's atmosphere is about 2000-million or 2-billion electron volts on the average. Careful measurements have shown that a significant number of the particles have energies as high as 10-billion electron volts.

The maximum energy level of individual particles from radioactive materials on the earth's surface is very much less than this although the overall energy involved may be very great—the effects of the atomic bomb are well known.

Because of their high energy, cosmic ray particles are responsible for many remarkable nuclear reactions. In fact knowledge of the existence of other atomic particles such as the positron and the meson is due to the presence of cosmic particles.

A study of these nuclear reactions has already lead to the development of the atomic engine as well as the world shattering bomb and it is certain that before long will have a vast effect on the world in which we live.

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Just over 10 years ago, Rola researchers completed laboratory tests on a revolutionary new output transformer — the Isocore.

So advanced was its design that today, with production topping the 750,000 mark, Rola Isocore transformers are still leaders in their field.

Each Rola loudspeaker transformer — both the Isocore which is moisture proof and protected against the corrosive effects of electrolytic action — and the widely used open types, is individually designed to provide best power output and frequency response from the valve with which it is to be used. Rola loudspeaker transformers are as famous as Rola loudspeakers.

And now to meet the needs of manufacturers, Rola has developed a whole series of the special types which are needed in television receivers. The design of these, too, reflects the skill and manufacturing precision associated with the Rola name.

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ralian Department of Mines proluced.

"From a portion of the pure ıranium metal we produced we cast . small sample for presentation to he Premier of South Australia (Mr. Playford).

"The sample was about three imes as thick as a two-shilling piece nd a little bigger."

Professor Myers said the pure ıranium metal was sufficiently adioactive to cause anaemia or terilisation to any person who andled it long enough.

"Anyone handling the metal hould wash his hands afterward," e said.

Professor Myers said University f Technology physicists would coninue to produce pure uranium netal.

But this would become incidental o a study of the extraction of ranium metal and its alloys.

These alloys might be extremely seful as reactor elements for future ower production.

Better movies

ILM critics have hailed a new CinemaScope film process as a reat improvement on the original echnique.

The new method is to take photoraphs with a 55mm camera and educe the pictures to a 35mm film or greater sharpness of detail.

Producer Darryl Zanuck told film xperts and theatre owners that the ecision to use 55mm film followed xtensive tests, using many other lm sizes.

"Any amateur photographer knows hat when you enlarge a snapshot, he bigger you make it the more he grain becomes apparent," he aid.

"We have reversed the process. By hooting it on the large film and educing it to 35mm, we have eliminted grain."

The Daily News film critic said ne result gave "a sharper screen nage, completely free of distortion nd breathtakingly faithful to detail".

Scatter" transmission

NGINEERS have successfully tested a new broadcasting system nat may hold the key to interontinental television.

The tests extended the range of a elevision signal to 188 miles.

The New York Times, reporting ne experiments recently, described ne new technique as "scatter TV".

The range of conventional teleision is usually limited to about 0 miles, depending on the height f the broadcast tower and the eceiving antenna.

"Scatter" transmission bounces gnals off the troposphere at elevaons of one-half to two miles.

With reasonable power and anennae, the technique might extend he range of television to 300 miles, he newspaper said.

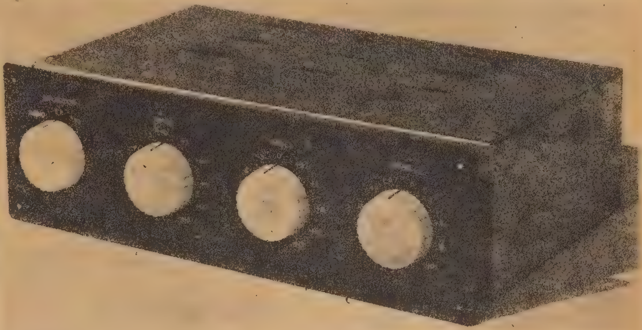
By bouncing signals off the ionophere, 70 miles up, voice and teleype communications could be exended to 1200 miles.

The advantage of this technique ver present short-wave methods vas complete stability and freedom rom interference.

The US Air Force expected to omplete in the next six months a scatter network" linking London nd Washington.

DOES YOUR PRE-AMPLIFIER DO JUSTICE TO YOUR PICKUP?

You can have a response 30-20,000 c/s plus/minus 1 db with less than .5 per cent distortion at 5 volts output with M.B.H. Pre-Amplifiers.



TYPE B

The M.B.H. Pre-amplifier was produced with the object of providing a control unit of sufficient refinement to make optimum use of the signal produced by the M.B.H. Pick-up.

Efforts to reduce distortion both at the highest and lowest recorded levels have been so successful in this circuit that it is capable of giving 20 volts output before the intermodulation distortion reaches 1 per cent. This means complete freedom from overload distortion at the highest recording levels.

This is achieved by a circuit using three valves, each having a high degree of feedback. In addtion all equalisation is carried out by feedback, a method which still further reduces distortion, noise and hum being reduced to inaudibility.

The aim of simplicity of operation has been realised by having a selector switch with only three positions. Radio, L.P. and 78. On the L.P. position the equalisation follows the R.I.A.A. curve, which is rapidly becoming the standard. When playing discs recorded to one of the other curves used, the maximum error is only about 3 decibels at the worst point, and this trifling error is simply corrected, if necessary, by adjustment of the bass or treble control. These controls provide bass and treble boost or cut of up to 15 decibels in accurate steps of 3 decibels measured at 50 c/s and 10 Kc/s. This method of final setting by ear has been found to be more satisfying than attempting to provide a large number of equalisation curves. The reason is, that discs, even when recorded to the same cutter characteristic, vary widely in their actual balance of bass and treble. The final arbiter is in any case, the listener. Low noise and low distortion are of far greater importance than hair-line accuracy to recording curves, which, in practice are little better than rough guides.

The slow slope of the tone controls gives an effect similar to a change of seating position in a hall, because relative strengths of treble and bass are very sensitive to changes of position. The treble control is of use for attenuating scratch on poor records without the complete loss of any frequency. A sharp cut scratch filter has not been deemed essential, due to the notable freedom from scratch in M.B.H. Pick-ups.

The complete pre-amplifier and power supply are built into a compact case. The input transformer used is the M.B.H. Triple Shield. The power transformer is a hum-buck wound type. It is only necessary to connect the pre-amplifier to the 240 volt supply, no tapping of voltages from main amplifiers is required. The pre-amplifier can be used up to 20 feet from the main amplifier, provided coaxial cable is used to connect them.

TYPE A

Type A is identical with type B except that potentiometers are used for the treble and bass controls.

PERFORMANCE AND PHYSICAL DATA

Frequency Response. plus and minus 1 decibel 30 c/s. to 20,000 c/s. Gain. Radio plus 17 decibels; Pick-up plus 47 decibels. Distortion. Less than 0.5 pc for 5 volts output. Signal to Noise Ratio. minus 60 decibels. Mains Voltage. 240 A.C. Case Dimensions. 12in x 3½in x 6½in deep. Panel size. 12¼in x 3¾in.

RETAIL PRICE
TYPE A £42
TYPE B £54/12/-

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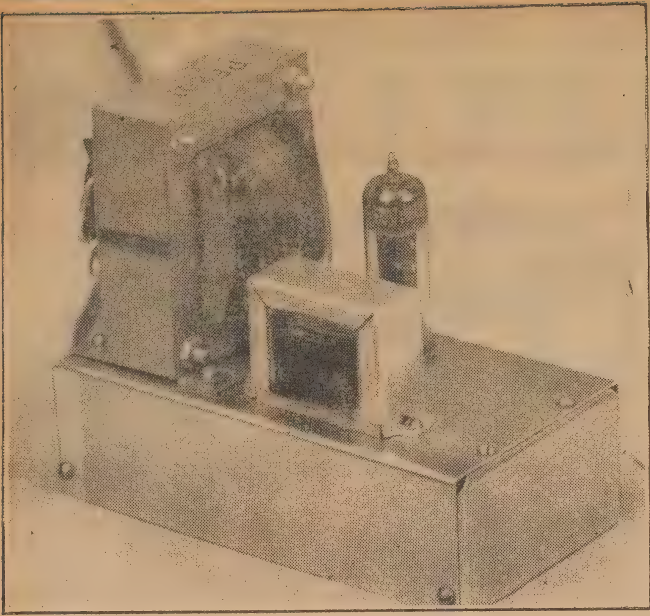


Photograph of the extra power unit. It is connected to the main amplifier via a cable from the rear. Any components which will give from 200 to 250 volts will do. The size and layout of the parts are not critical. They could even be included on the main amplifier chassis if there is room.

CONTROL UNITS UP TO DAT

Here are two simple projects which will interest builders of the Playmaster amplifiers and Control units. One is an auxiliary power supply for the control units and tuners, the other modification of control units to provide for the RIAA recording curve.

FIRST the power supply and the reason for its use.

In any high gain amplifier system there is always an attendant risk of low frequency instability (or "motor-boating" as it is commonly called) and a stubborn case which defies all other efforts will normally respond to the use of a separate power supply for the early stages, such as the control unit and/or tuner.

A few of our readers, faced with just such a problem, have already adopted this cure and have suggested that we describe such a power supply for use with the Playmaster series.

NORMALLY STABLE

Now the Playmaster series of amplifiers is normally commendably free from motor-boating and oscillation troubles. In their design, we took great care to provide adequate bypassing, filtering and an optimum amount of feedback with this end in view.

Almost any amplifier which combines high gain with an extremely wide frequency range can be made to oscillate if abnormal conditions are produced, such as opening the gain control to its maximum and turning all the bass boost as wide open as the controls will allow.

One must consider, however, that it would be quite impossible to operate the amplifier in this way for normal use. The conditions under which maximum bass boost would be required are almost certainly those of low operating levels, where perfectly stable operation will be experienced.

However, there have been odd cases where readers have run into trouble.

There are many reasons for this: low value filter capacitors, different types of output transformer, variations in the feedback network, attempts to produce greater amounts of bass boost, and so on. In all such cases it would doubtless be possible to cure the trouble by reverting to the original design in all respects, but this is not always convenient or economical. Hence th approach of cutting one's losses an providing a separate power suppl

Even where the original desig has been followed, a peculiar combination of circumstances might ye render one version unstable wherea another, apparently the same, prove to be satisfactory.

And just what causes this troubl in the first place and how can separate power supply effect a cure

First it must be realised tha motor-boating is simply a form c oscillation, at a very low frequenc to be sure, but oscillation nevertheless. The most troublesome forn of oscillation is due to couplin between high level stages, such the output stage, and the early low level stages. In other words, it positive feedback but in such a forn that it occurs at very low frequencies.

POWER SUPPLY CULPRIT

As you have probably guessed, th culprit is the power supply an more particularly, its regulatio characteristic. The fact that th problem appears to have becom more acute in recent years doesn mean that power supply design ha deteriorated. In fact the reverse true. The real trouble is that improving amplifier design and components in recent years has place greater and greater demands o power supply regulation.

A few years ago most pickup including even the magnetic type were capable of at least half a vo output and had a certain amount "built-in" bass boost. A simple tw stage amplifier was all that w needed for best results (by the th standards) and such things power supply regulation were hardly considered.

Then came microgroove recor low output—but high quality—pic ups, and a shifting of the job record compensation from the pic up to the amplifier. There is al the provision of additional ba boost to compensate for individu recording faults, speaker limitatio or simply a desire to make the resu sound nothing like the original!

All this means so much gain the low frequencies that the be power supply may be only just goo enough. A stage may ultimate be reached where it becomes mo satisfactory and more economical divide the power supply into tw sections, rather than to develop gr hairs trying to produce a perfe single power supply.

Such is progress!

In a typical high-gain system, it nay be necessary to allow for an nput voltage as low as 10 milliolts (at 1000 cps) plus additional ain at lower frequencies to provide ompensation.

The implication of this latter equirement is not always fully ppreciated.

In a typical case it may be necesary to provide 14db of additional ain at 40 cps, merely to compensate or the recording characteristic. Boost required for special effects will be over and above this and may mount to another 12db or more.

Now a voltage gain of 14db is a atio of approximately five to one, neaning that the gain at this freuency has to be five times greater han it is at 1000 cps. Add to this nother 12db of optional boost and he ratio jumps to 20 to one.

ELATIVE GAINS

This means that an amplifier with nominal sensitivity of 10 milliolts at 1000 cps would have a sentivity of .5 mV around 40 to 50 ps and possibly even lower than his at lower frequencies, if the bass esponse of the system is sustained. Certain response curves may be ven more demanding.

The fact that it is normal pracce to do everything possible to hold up" the bass end of the nplifier is just one more factor hich aggravates the problem.

The result is a colossal order of ain at the lower frequencies—much gher than is implied by the nomial sensitivity figure of the amplier—and it is not hard to visualise hat happens when the power supy regulation is not quite good nough.

A signal appearing in the plate rcuit of the output stage creates cyclic demand for current from the ower supply or, more specifically, e last filter capacitor.

At low frequencies this demand ay be sufficient to discharge the apacitor to the point where there an appreciable drop in the voltge across it.

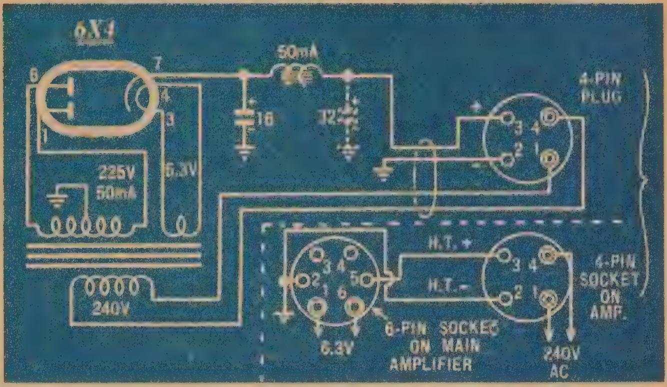
This change affects the entire HT ne, and can thus appear in the ate circuit of the earliest stage. rom this point it is treated by e remainder of the amplifier xactly as if it were a genuine sigal and appears in the output stage cause another surge of current. o the process goes on, building p until an unstable condition is ached.

MPORTANCE OF FILTER

In the design of any amplifier e take a number of steps to miniise this effect. Early stages are ormally decoupled, which means at they have their own filter capator and are not too intimately oupled to the main HT line. The ain power supply itself is also made have the lowest possible impednce, consistent with reasonable conomy and space requirements.

A single-ended stage is about the orst possible arrangement where gh gain is involved since a sigal applied to it results in quite rge changes in current drain from stant to instant. For this rean it is usual to employ pushull output systems which are much ss exacting in their demands on e power supply.

CIRCUIT OF THE SMALL SUPPLY



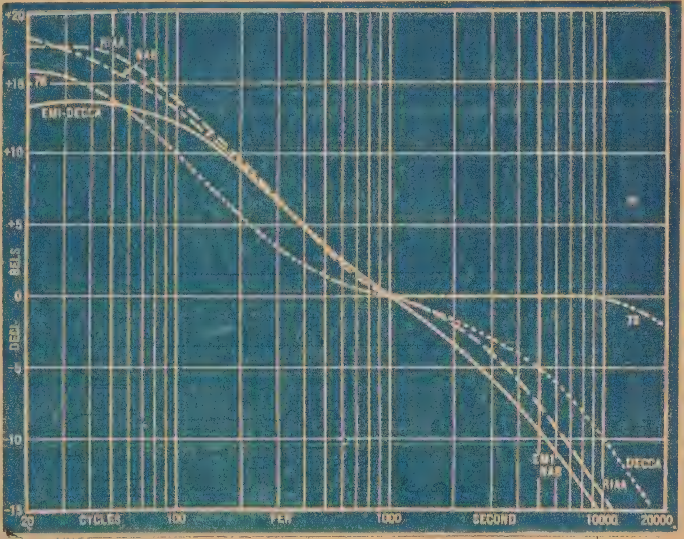
The circuit is very simple. The dotted 32 mfds condenser may be included in the unit, but you will find one already installed in the main amplifier, making additional capacitance unnecessary. The cable connecting terminates in a 4-pin plug which fits into a 4-pin socket mounted on the amplifier.

REGULATION PROBLEMS

In fact, if we had a pure class A system, perfectly balanced as to drive, valve characteristics, &c., we should be able to entirely eliminate variations in current drain due to signals. Since it is virtually impossible to produce, or, at any rate, to maintain such a perfect system and because, for reasons of economy, we often wish to drive a push-pull system into the class AB1 condition, it is inevitable that there will be some variation in the current drain of the power supply.

While such variations will be many times smaller than in the case of a single-ended system, the fact that they do exist means that it is only a matter of providing sufficient gain in the system and we are in trouble.

The problem is further aggravated by the common practice of employing a feedback loop which includes the output transformer. All output transformers have a tendency—some much more than others—to introduce phase rotation into the feedback network at low frequencies.



The curves shown here are valid for both units. Note that we have included some bass roll-off for the 78 position to guard against motor rumble and other low-frequency noises. Omitting the .047 resistor in the circuit will remove the roll-off and restore the theoretical 78 curve. To get near NAB add one notch of bass boost to the EMI curve. To get near AES, add one notch of bass boost to the 78 curve, and three notches of treble cut.

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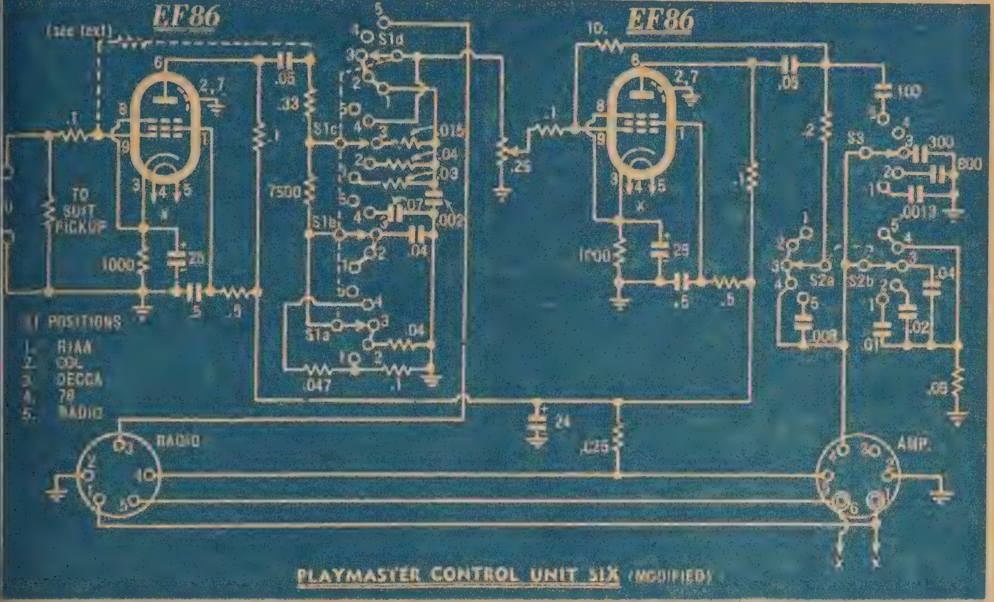
MODIFIED CIRCUIT OF THE CONTROL UNIT SIX



ere is the Control Unit Six circuit modified for the changes mentioned in the article. The resistor marked "see text" is a feedback resistor to be added if some gain reduction is needed.

his means a tendency toward tive feedback, and, even if it nowhere near enough to cause ble by itself, it can increase the frequency gain and provide the t straw" when combined with power and supply problem.

might not be so bad if the ble was simply a straight out inuous motor-boating effect. At t one would recognise the fault seek to cure it. In its most dious form it may only occur one or two cycles, and then when shocked into action by presence of a heavy bass sig-

he result is a very ragged bass ponse, accompanied by extreme e movement, which may even age the speaker suspension sys-. It can also aggravate the lem of motor rumble, since the uencies generated by the latter in the same general region and accentuated if the amplifier is a state of near-regeneration.

EARATE SUPPLY

you have a problem of this d and it has not responded to the normal approaches, you ht well consider the separate er supply as a possible solu-. Even where it is felt that set-up could be made to dupli- the performance of the orig- it may often be easier—and a d deal cheaper—than trying to eve this ideal.

he power supply itself is a le affair. We made up a small sis of 18 gauge aluminium mea-ng 5½in x 3in x 1½in and most ers will be able to make something similar. Alternatively you may care to buy the chassis specified for the Micro-Amp described in the December 1955 issue. This is a little longer and has a few unwanted holes, but will suit in most cases.

The transformer is the popular 225-volt 50-mA type, while the choke may be any type having at least a 50-mA rating and about 12 henries inductance. The first electrolytic is best limited to 16 mfd in order not to impose too great peak current demands on the rectifier. There is no limit to the size of the second one, but a 32 mfd should be adequate.

FILTER VALUES

There is little point in providing more capacitance than this, since most units will already have their own decoupling circuits to provide an extra filtering stage. At the same time there is plenty of room under the chassis if another capacitor should be needed.

In actual fact, all Playmasters include a filter capacitor wired to the six-pin socket carrying the high voltage lead to the control unit and tuner. This can remain as the "second" filter capacitor of the small supply, requiring only one electrolytic to be included in the circuit.

We used a 6X4 rectifier which is quite large enough for the job. However, if a 6V4 should happen to be available it could also be used, though its higher current rating is really wasted.

Similarly, almost any odd transformer, choke, and rectifier can be used, and many fellows will have suitable parts on hand. Even if the voltage delivered is a little on the high side it can be offset by the use of a dropping resistor or larger decoupling resistors in the various units.

Output from the supply is by means of a cable terminating in a four-pin plug. The mains lead is connected to the filament pins, and the negative and positive leads to the other two. A four-pin socket is mounted at the side of the main amplifier with appropriate leads connected to it. The high tension lead runs direct to the six-pin socket provided for the control unit connecting cable. The dropping resistor in the amplifier which originally supplied voltage from the large power supply is, of course, removed.

These points are clearly shown in the circuit diagram.

UNUSED FILAMENT

There is no need to use any filament windings on the new power supply. In many cases the existing filament connections provide a small bias voltage to reduce a source of hum, and they should not be disturbed. The new supply provides high tension only.

Under no circumstances must the new power supply be connected directly to the control unit or the tuner. Certainly the volts will arrive all right, but because the new supply must be earthed through a three-pin mains plug, a very nice earth loop would be created which would introduce serious hum.

It is important that all connections

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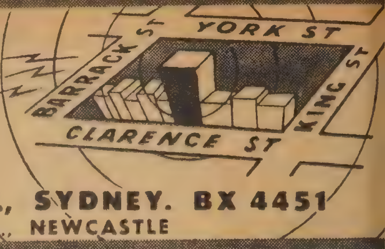

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be made via the main amplifiers as we have described.

To test the efficiency of the modification, a Playmaster 17-watt amplifier and No. 4 control unit were deliberately adjusted to produce motor-boating at full output when any degree of extra bass boost was added. To do this the feedback was increased by a large amount and a minimum of decoupling used.

On changing over to the separate supply, it was not possible to cause motor-boating at any setting of the controls. We desisted in our efforts to induce motor-boating only when problems such as acoustic feedback became evident and it was obvious that the speaker system was in danger!

The change-over had completely removed all low frequency oscillation due to power supply coupling.

The net impression is that the modification is so simple, particularly for the home-builder who usually has some odd components lying idle, that it is very much worth while including in the first place. The necessary bits and pieces could well be laid out on the main amplifier chassis itself.

CONTROL MODIFICATIONS

The major modification to Control Units Four and Six is brought about by the almost universal acceptance now of the RIAA standard playback curve.

When the units were first designed, this curve was only just being talked about, and there was no real evidence that it would meet with any better fate than did the AES curve, the first of the "standards to end standards".

But wonder of wonders, it did. It seems quite certain now that before long all microgroove records issued will conform to this curve.

The best evidence of this is found in a list published by the American magazine, High Fidelity, each month. This list gives the accepted playback curves used by just about all the recording companies selling records in that country. Until recent times it revealed a bewildering array of curves, many of which used the bass end of one curve and the treble of another.

This was one reason for the numbers of costly and complicated control units on sale here and there, with many knobs and buttons designed to fit these unorthodox playbacks.

TODAY'S CURVES

In the latest list, out of about 60 labels, 43 use the RIAA curve, 6 the Columbia or EMI curve, 7 the NAB curve, and 2 the AES curve.

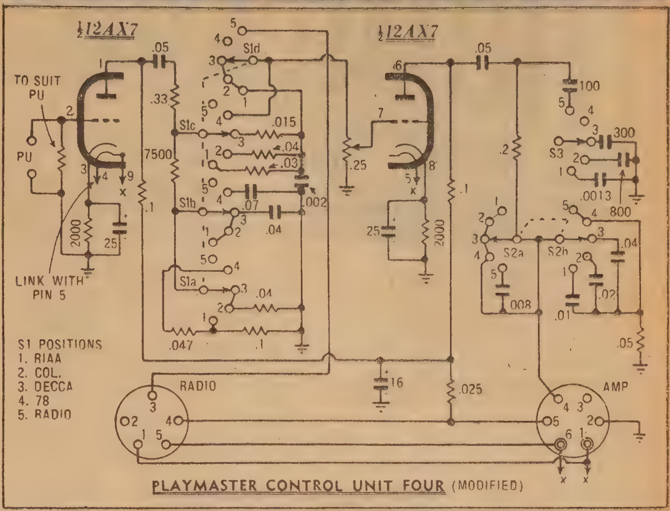
As many of the makes represented are unknown in Australia except for a few imported samples, and nearly all the major names are now using the RIAA, there seems no reason to delay any longer publishing circuits for our control units.

It should also be noted that many companies are using this curve for re-issues of records already in the catalogue, so that, unless you bought your older performances when first released, the chances are that even these will be RIAA from now on.

In checking up on the records now reaching us for review, it is becoming increasingly obvious that the RIAA is the best curve to use. Unfortunately it is almost impossible to get a clear statement on this point from the recording companies, but not so hard to add two and two together.

In designing the original units, we deliberately avoided numerous fixed settings. Most of the records issued up to that time were Decca or EMI, with a decreasing number on AES and NAB. After all, in working out a circuit for our conditions, we must give first preference to settings which will be most useful for the records you can buy here.

CIRCUIT OF CONTROL UNIT FOUR



The Control Unit Four modified as per text.

DROPPING THE AES

Because of the large numbers of EMI produced records, as well as those of Continental origin, which used the Columbia or EMI curve, and which occupy an honored place already in your collections, we felt that, as in the case of Decca, which was the first label seen here in any quantity, we must retain it. And because there are still plenty of 78's you will want to play, we would be foolish to eliminate its setting, even though it is a compromise curve arrived at by looking back into the years.

The AES curve, on the other hand, has no future, and did not get very far when considering the total number of discs issued here. If one had to be dropped, it seemed that the AES would be the one to go.

So we have made the minor alteration to component values needed to use the RIAA in place of the AES.

Any reader who feels he must have the AES can leave his unit as it is, and sacrifice the 78 curve in favor of the RIAA. Anyone who is so particular won't mind this, as obviously his interests lie in more modern discs. As we pointed out early in the piece, 78 discs often sound best with the AES which gives them some top cut, without which many sound too scratchy by modern standards.

It is possible to approximate the NAB curve by adding one degree of bass boost to the EMI curve, but it is not so easy to produce the AES by any such procedure. The nearest would be to set up the EMI curve, then add one notch of bass boost and one of treble boost.

If we are realistic, and remember that in any case there is a plus and minus figure of 2 db on all playback curves, it is obviously possible to come pretty near what we want. In the original articles on curves published when the units were first described, we showed this point very clearly. To become a slave to small increments in playback is to suffer more from a form of self-delusion than anything else.

EXTRA CONTROLS

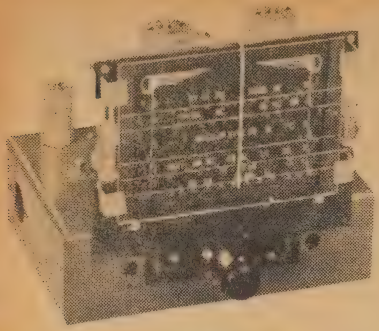
The proof of the pudding is in the eating. Over the years of record reviewing, which involves listening to 25 new discs or more per month, we have always found it possible to get a perfectly satisfactory result by using one or other of the three curves mentioned, plus or minus a small amount of bass and treble supplied by the auxiliary controls.

That is why these extra controls were arranged to give steps of 4 db up or down in both bass and treble. This increment is just about right to provide a variation which can be positively appreciated, but even then, few discs need such reinforcement.

Similarly, as bass boost and treble cut are easily the most valuable adjustments, only one step each of bass cut and treble boost are provided.

The time may even arrive when a single RIAA playback curve will do, with continuously variable bass and treble controls provided for extra compensation, always provided that a zero position can be included for each in which the fixed curve is not affected. This isn't quite as easy as it might seem.

But the more particular type of user will probably always prefer the stepped controls which ensure that any auxiliary modification can be



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ade by adding or subtracting a xed amount of compensation.

One or two other points have merged from experience with these nits and have also been included

In the Number Six unit, where e wanted to design for the maxium amount of gain, the .33 meg esistor in the first divider circuit f the Number 4 unit was dropped o .25 to give a little extra lift, with slight modification to the bass ll-off after about 50 cycles. It veraged about 1.5 db short of the ublished curves at this point.

ESISTOR VALUES

Experience has shown that this nit has more than enough gain to ater for any pick-up likely to be sed, so much so that most users hrow some away by using feedback round the first stage via the reistor shown in the dotted line.

We have therefore reverted to he original value of .33 megs, so hat the curves are now exactly as hown in the diagram on page 33. hese curves are the same for both nits.

But if you do want a bit more ain from the first stage in either nit, the .25 resistor can be used ith virtually no audible difference.

Secondly, the 78 curve now is the nly one which does not provide for ome roll-off at the very low freuencies, and when the unit is used ith amplifiers such as the latest laymasters which have a very good w frequency response, motor umble, rumble from the discs themelves and so on may be unduly ccentuated.

We have therefore included an xtra resistor of .047 or .05 wired o that in this position it is added the .1 meg resistor in the RIAA osition to give a roll-off as indiated in the diagram.

You can please yourself about this, ut we have found it very useful, articularly because the 78's are a ariable factor and often accentuate oises too low to be useful and low nough to be a nuisance.

We have also found it very imortant to see that the peak output om the pick-up is not enough to verload the grid circuit of the first alve in either unit.

VERLOAD FIGURES

It is hard to quote a figure for his, but we might arrive at it by uggesting that an average output f 50 millivolts should be the maxium for the Control Unit Four, nd about 150 for the Number Six.

The latter is a very handy unit ecause, by adding feedback to the rst valve, we increase the voltage he grid circuit can handle. For a ick-up of 100 millivolts or so of utput, we will have to use a fair mount of feedback to reduce the ver-all gain to a useful figure, and he danger of any overload is autoatically eliminated.

There is no point in having a olume control setting of less than bout half-way for the loudest volme we require, and feedback may e added by using the appropriate esistor value to bring this about.

As a reference, a 10 meg resistor s used in the second stage will roduce about 6 db of feedback and gain reduction of about 2. Values f 1 or 2 megohms will give very igh degree of feedback, and it

(Continued on Page 115)

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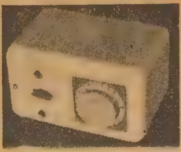

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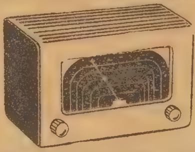

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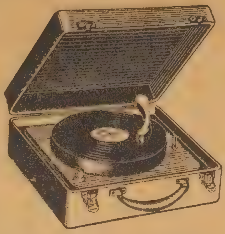

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HOW TO LINE UP YOUR RECEIVER

The most expensive racing car in the world won't perform if its valve adjustments, ignition timing and all the other necessary critical settings are not accurate. Neither can you expect to get the best out of a superhet receiver unless all the tuned circuits are correctly aligned. This article, which applies to almost all modern receivers, shows how to carry out the correct procedure without expensive instruments. It is based on a very popular article which appeared in Radio and Hobbies for May, 1954.

IN a factory, receivers are aligned with the aid of a signal generator and an output meter. If you have such instruments available, there is no doubt that the best job can be done in the shortest time with their aid. However, if you have the instruments or access to them, it is unlikely that you will be lacking advice in their use.

The chances are that you do not have a signal generator and output meter and that you could borrow hem only at considerable inconvenience. Well, then, this article is for you!

If you are prepared to take a little trouble, an excellent job can be done using broadcast signals in place of he signal generator and using your ears in place of an output meter as a judge of variations in volume.

SOME LEEWAY

It takes a little longer and the final result may be a few points down on the instrument job, but the ew extra minutes are not likely to be of any consequence and most modern receivers have a reserve of performance so that they will do a good job even if a little out.

We have proved the point in our own laboratory. First of all a five-valve superhet was aligned as accurately as possible with instruments and readings of sensitivity taken with the signal generator and output meter.

Then, so that there was no possibility of cheating, the receiver was deliberately misaligned by another member of the staff, after which it was lined up in the manner we are about to describe.

A second set of sensitivity readngs was taken with the aid of the nstruments so that the sensitivities on instrument alignment and manual alignment could be compared.

We were agreeably surprised. Without the aid of instruments, the difference may not have been deected. Possibly we were just plain ucky, but it does prove that you hould not sidestep superhets beause you do not have a set of intruments to get them going.

PRELIMINARIES

If the alignment is to proceed moothly there are a few preliminaries to be considered. First of all the relative positions of the tuning capacitor and the dial pointer must be adjusted.

We've noticed a move for the beter in the case of some of the latest dials where the pointer position with he capacitor plates fully in is marked. It is then simply a matter of tightening the locking screw on the dial drum with the capacitor and pointer in the correct positions.

If it is not marked, you can arrive at the correct position as follows: Measure the distance between the 550 Kc calibration point and the 600 Kc point. Divide the distance by two and set the pointer on the low frequency side of the 550 Kc calibration point by this amount. Lock the dial drum with the capacitor plates fully in. The lower limit of the band will thus be about 535 Kc.

If the mechanism will not rotate the capacitor through the full 180 degrees without straining the cord at one of the extremes of the range, it may be necessary to do some adjustment. You can arrive at the correct result by altering the position of the pointer on the dial cord.

DIAL CORD TENSION

The tension of the dial cord is important for smooth operation. If it is too loose the cord will slip on the control shaft, and if too tight it will be hard to turn, and you will not get full benefit from the flywheel action of the dial in running from one end of the band to the other.

In general it is necessary to have the dial cord twisted twice around the control shaft to prevent slip while at the same time keeping the tension down to a reasonable amount.

In the case of a five-valve superhet receiver there are usually about eight adjustments of the tuned circuits provided, and in order to achieve the desired results, you must adopt a definite procedure.

The adjustments on the intermediate frequency transformers, the aerial coil and the oscillator coil are checked during the final inspection at the factory, but these are bound to be upset by the addition of the various components and the wiring of the receiver.

However, they will usually not be too far out, and there is some point in recording the original positions of the slugs just in case something goes wrong and you wish to go right back to the start.

THE TRIMMERS

As they come to you, the trimmer capacitors will not have any particular setting. It is a good idea to adjust the outer plate so that minimum capacity is achieved with some tension still between the plate and the adjusting screw, in case the set happens to line up in this position. You will, of course, have made sure that the trimmer plate which touches the adjusting screw is soldered to the frame of the gang.

An ordinary screwdriver is quite in order for adjusting the trimmers, but, in the case of the iron-dust cores, the presence of the screwdriver may have some effect on the setting, so that the correct setting with the screwdriver in place may not be correct when it is removed. This is particularly so in the case of coils which employ iron dust cores with the screwdriver slot cut in the core itself.

Special aligning tools which employ a small metal tip on the end of a shaft of insulating rod are available. Ordinarily, the amount of metal involved is so small that it does not make any appreciable difference to the tuning.

Alternatively, a screwdriver point can be sharpened on the end of a piece of fibre rod. Failing fibre rod, a narrow strip cut from a piece of sheet bakelite can be used as raw material.

Go over all the adjustments with the aligning tool before you switch the set on to make sure that they all operate smoothly, because it makes it difficult if you have to leave off in the middle of the alignment to make a mechanical adjustment.

Connect the set up to an aerial and earth, preferably the ones with which it is to be used, connect the speaker and switch the power on. Tuning across the band, you will probably be able to hear quite a few stations, if the set is all in order, apart from alignment.

THE IF END

Try to find a weak but steady station near the low frequency end of the band. There is some advantage in doing the job in daylight, because the weak stations are more likely to be steady than at night.

Tune the receiver as accurately as possible to the station you choose. The best way to do this, or in fact to make any of the adjustments about to be described, is to rock the setting backwards and forwards over the correct point gradually converging on it.

You can now adjust the IF transformer cores or trimmers as the case may be, (most modern IF transformers have core adjustments) for maximum sound output from the speaker.

It is possible that what was previously a weak signal now becomes a strong signal as the sensitivity of the receiver rises. This being the case, do the best you can on the original station, and then tune accurately to a weaker station and go over the procedure again.

There is a special reason for choosing a weak station. Most receivers incorporate an automatic

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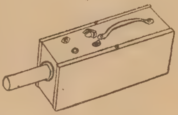

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olume control system. which tends keep the output from the tuner ction of the receiver constant. en though the signal varies in rength cver wide limits. The circuits of the receiver are usually such at the system does not work on ry weak signals, and therefore the ll sensitivity of the receiver is vailable when required.

/HY A WEAK STATION?

If strong signals are used for ignment purposes, the automatic olume control tends to mask the ljustment, making the correct setng difficult to find.

When you have finished with the transformers they should be fair- close to the nominal frequency. his is 455 Kc for most receivers owadays, but occasionally you will rike a receiver with a different rangement. For this method of ignment it doesn't matter, and, rther, even if you do finish up a w Kc off the specified frequency, will not be serious. The main ing is that all IF circuits be acurately aligned to the one freuency.

At this point we will digress a oment to introduce another subct. The intermediate frequency nplifier of the receiver, consisting the IF valve and the IF transrmers provides a substantial poron of the total amplification of the ceiver.

Changes in layout, wrong comonents or long leads may allow some the energy frcm the output of the nplifier to be fed back into the put. This may build up in strength ntil the amplifier eventually generates a signal on its own account. other words, it may "oscilate".

SCILLATION

This signal with the heterodyne or eat" with the signal being reived by the aerial will cause a histle in the output.

An oscillation whistle will appear all stations, and will vary as the ning is varied, although it may sappear as the set is tuned acrately to a strong station, because e gain of the IF amplifier is reced by the AVC.

The important thing is to realise at has happened if the IF amplir does happen to oscillate and en to set about finding out how ur wiring differs from the original. you strike trouble there is no point going on with the alignment until e fault is found.

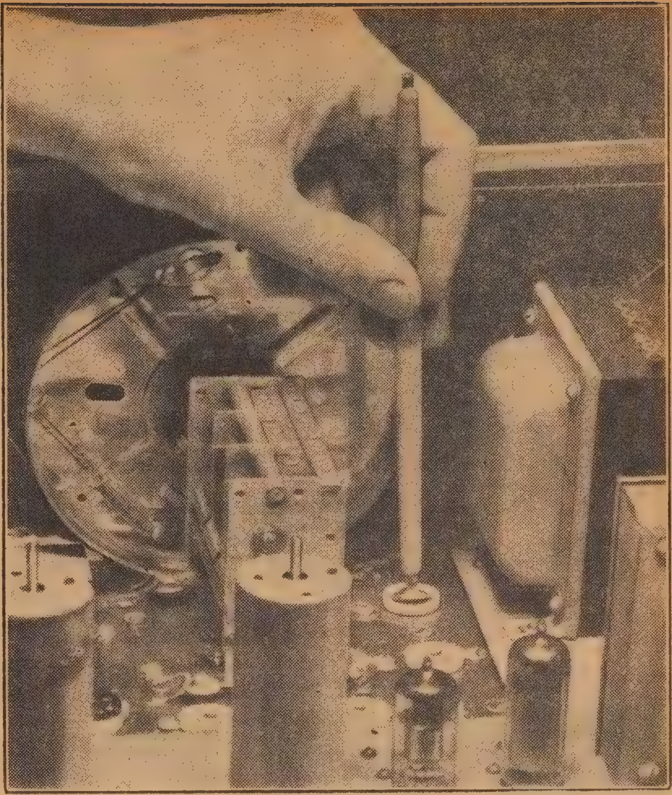
ortunately, the chances are that erything will go smoothly right ough the whole procedure. A uple of odd whistles on stations ar the centre of the band only can be ignored. They will tend to be ss obvious once the alignment is mplete.

Having satisfactorily completed the alignment of the IF amplifier it mains to adjust the aerial and oillator circuits.

By the way, if your receiver has RF amplifier stage, the adjustnts for the RF coil are exactly the same as for the aerial coil.

With most modern receivers the ustments consist of trimmers and riable slugs associated with both aial and oscillator coils, and the pdder capacitor is a fixed mica te.

You may be called upon to rean an older receiver with coils of fied inductance and variable padder, so we will describe the procedure later.



This picture shows many points of alignment in a multi-band set. The IF transformers in the foreground are easily identified with their iron slug adjustments. The lining tool is in position to align the RF coil trimmers.

In the case of the variable slugs, tune to a station which you can easily identify toward the low frequency end of the band and adjust the oscillator coil slug until the station coincides with its position as marked on the dial.

Then tune to a station toward the high frequency end of the band and adjust the trimmer associated with the oscillator section to bring this station to its correct position on the dial.

Repeat the above adjustments a couple of times because each adjustment does have some effect on the other.

If everything is in order, i.e., the dial and tuning capacitor correctly matched, all stations should now coincide with their marked positions on the dial.

Should the AVC system tend to make the strong local stations appear broad it would be in order to remove the aerial or operate the set with a short length of wire while making the adjustments to the station positions.

Finally, the aerial coil slug and the aerial trimmer should be adjusted to obtain the strongest signals. The slug adjustment should be made toward the low frequency end of the band and the trimmer adjustment toward the high frequency end.

The aerial circuit should be adjusted with the aerial with which the receiver is to be used connected, and it is a good idea to go over it several times to make sure that you get the best results.

By this time the set will probably be very sensitive, and you may not be able to find exactly the sort of signal you require. In this case it is quite in order to tune the set off a station and adjust for the greatest noise output.

The procedure is a little different if you are called upon to realign an older receiver which is fitted with a variable padder capacitor. The inductance of both aerial and oscillator coils will most probably be fixed.

The first thing to do after adjusting the IF transformers is to tune to a weak but steady station toward the low frequency end of the band and then find the setting of the padder capacitor which gives the loudest signal. Unfortunately, every time you shift the padder, the position of the station alters.

The job is made easier if you hold the alignment tool in one hand and the tuning knob in the other so that you can rock the tuning capacitor backwards and forwards over the station while the padder is being adjusted.

The grub screw securing the dial drum to the capacitor shaft should

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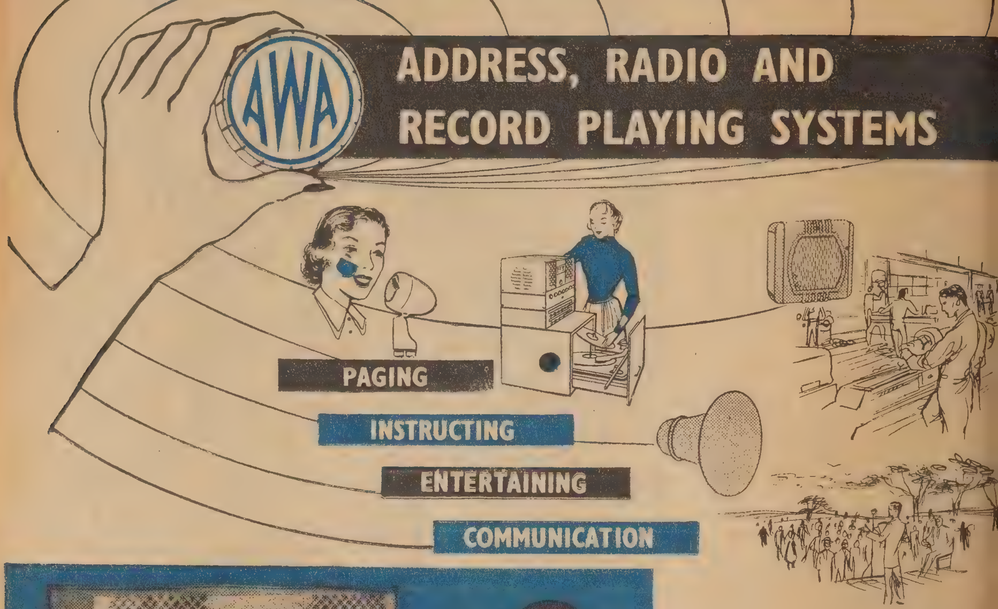

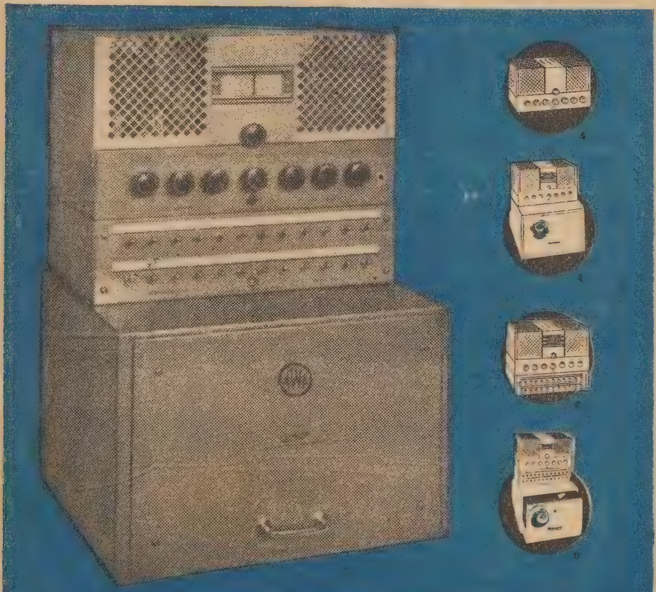

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then be loosened and the pointer made to coincide with the station's position on the dial.

At the high frequency end of the band, the two trimmer capacitors are adjusted as before, the oscillator trimmer being used to control the calibration and the aerial trimmer to give the best sensitivity.

Modern aerial coils are designed so that the alignment is little affected by the aerial be it long or short, but some of the earlier aerial coils may not be above reproach in this respect and in any case we suggest that you do the final adjustment of the aerial trimmer with the aerial connected.

To this point we have spoken only of the broadcast band. The procedure for the shortwave band or shortwave bands is essentially the same, but there is the added difficulty that it is often difficult to find and identify a suitable station for alignment.

Conditions vary a great deal, and sometimes change within a matter of minutes. Therefore, do not be discouraged if first results are not very satisfactory. Of course, the aerial is more important than in the case of the broadcast band, because you frequently wish to listen to very weak signals.

Shortwave listening is one of those "bugs" that sometimes bite hard and the real enthusiasts often go to the rouble of erecting special aerials. The disadvantage is that a really effective aerial is usually resonant, and for this reason will only work over a relatively narrow band of requencies.

However, most of the main shortwave stations of the world are heard very strongly in Australia, and even a poor aerial will often receive them at considerable strength.

S.W. ADJUSTMENT

As a first step, we suggest that you eave the shortwave oscillator coil lug at its original factory setting. The aerial slug (and RF slug, if fit- ed) should then be adjusted for the oudest signal, or background noise, t the low frequency end of the range. Now set the trimmer capacitor across the oscillator section to about the middle of its range, and with the set uned to the high frequency end of the band, adjust the aerial trimmer for greatest output on noise or a signal.

The calibration can be checked later by noting the positions of stations of known frequency.

Toward the low end of the band use the oscillator slug for adjustment and toward the high end of the and, the oscillator trimmer, always ringing the aerial circuit into line fter an alteration has been made.

This use of the slugs for low frequency adjustment and the trimmers for high frequency adjustment is a rule you should apply when lining up any of the RF circuits.

IDENTIFICATION

An excellent frequency check with an extremely high order of accuracy is the American station WWV. It transmits on a number of frequencies, but those most likely to be eard in Australia at good strength re 5.0 Mc, 10 Mc and 15 Mc, or 60 meters, 30 meters and 20 meters respectively.

The signals can easily be identified y the 440 and 4000 cycle tones which re superimposed on the RF carrier nd the fact that the tones are interrupted by a 1-second pulse. The pulse is omitted on the 59th second of every minute and there are other interruptions at regular intervals for call sign announcement and other purposes.

Apart from this, the shortwave notes published in each issue will help you to determine the sort of conditions that can be expected. Remember that, unless your set is a fairly elaborate type with bandspread ranges, the tuning is likely to be a good deal more critical than on the broadcast band, and therefore it takes more time to find and identify stations.

Some readers may be concerned as to the best position at which to set the volume control while making the adjustments. The control has no effect on any of the settings. However, you may find that it is possible to get a more easily recognisable change at some volumes than others.

It is not a good idea to turn the volume too low, because the effect of the adjustment may be difficult to appreciate in the presence of other sounds. On the other hand, there is no need to set the control so that everyone for a mile around is aware that you are doing some radio work.

Carefully carry ont the procedure we have decribed and there is every chance that your set will perform very much better as a result of your efforts.

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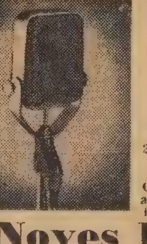
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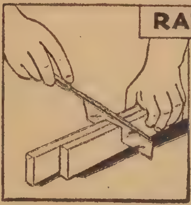
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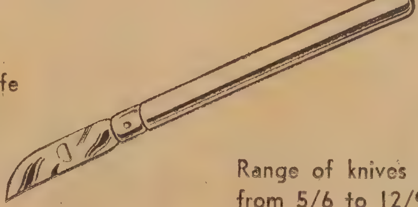
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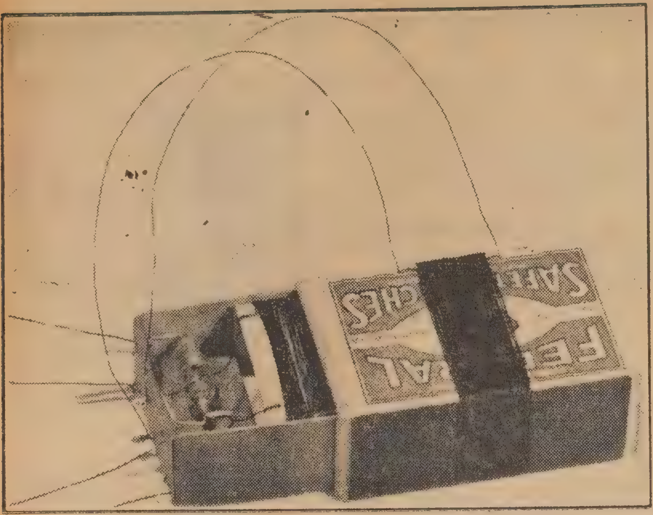


Here is the complete set all ready to start picking up stations. Tuning is done by sliding the tray inside the matchbox cover. Nothing could be simpler.

A MATCHBOX CRYSTAL SET

Here is a complete working radio receiver which can be built inside a matchbox. The parts could easily come from a friendly radio experimenter's scrap stock but, if you have pocket-money to spare, both crystal and capacitor can be purchased new for a few shillings. Good results are guaranteed and, by following the diagrams, you can put the set together in half an hour.

WHY put a set inside a matchbox? No particular reason—except, perhaps, that the parts for the slider mechanism are made and then, of course, such a tiny radio that can be made for next to nothing is a real novelty.

To be perfectly fair, we do remember having seen designs for matchbox crystal sets in other publications, notably American, but it is such a long time since one was described that few of our younger readers will remember.

There is no point in wasting time on preliminaries; we will start right in to give you an abbreviated idea of how a crystal set works, how it compares with other sets and then how to make this particular one.

We hear a lot about valves—1-valve sets, two valve sets, &c., but the heart of any radio receiver is actually the tuned circuit. Without the tuned circuit all the stations would be heard together and if two happened to be of about equal strength you wouldn't be able to get much enjoyment from either program.

The simplest set you can make consists of a tuned circuit to pick out the station you want and a crystal detector which makes the signal suitable for passing on to the headphones.

We won't worry about the theory right at the moment but this tuned circuit we have been talking about usually consists of a coil of wire and a variable tuning capacitor. A good coil is fairly easy to make but the tuning capacitor is a pretty big project. A factory-made one will cost you about £1.

On the other hand you can buy a fixed capacitor for about 1/- and make up a coil which has a variable inductance so that you can tune in the different stations. Nothing could be simpler!

The coil for this set is made up in two parts, one wound around the outside of the matchbox and the other around a former made from a piece of card which fits snugly inside the inner tray.

HOW TUNING WORKS

Depending on the way the wires are connected and the direction of the windings this coil, in two parts, will behave as a large coil or a small coil. A continuous range of intermediate steps can be obtained by sliding the inner tray in or out of the box by different amounts.

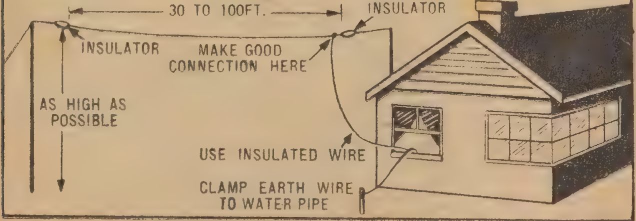
So, in order to tune in the stations you simply slide the inner tray of the box in and out. One extreme of the range will be found with the two coils one right inside the other and you will go toward the centre of the range by pushing the two sections of the matchbox apart, perhaps even until they are separated.

For the other part of the tuning range turn the tray around end to end and, without disconnecting the wires, push the two sections together. The other extreme end of the range is reached with the two sections of the matchbox fully together in the opposite direction to the first.

Low frequency stations are tuned when the two coils of wire are wound and connected so that they are assisting each other and high frequencies when the two coils are opposing.

THE COILS

We have carefully worked out the number of turns on the coils so that the set tunes over the broad-



This aerial and earth system will work well with a crystal set. The supports don't need to be poles: buildings, trees etc. will work just as well.

HOW TO ASSEMBLE THE RECEIVER

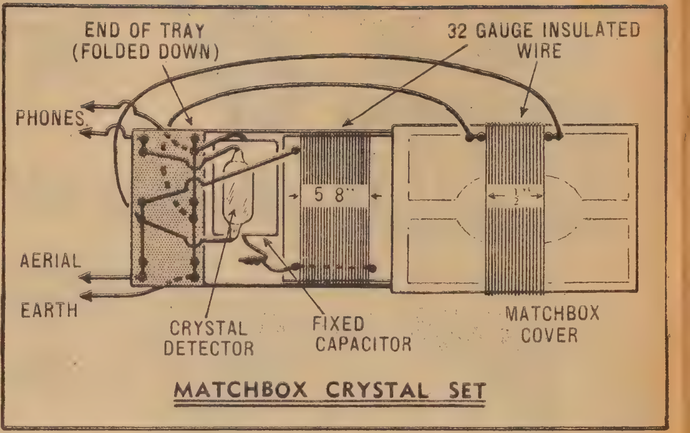
cast band and there is no need to worry about frequencies, &c., unless you particularly wish to do so.

We started making the set by winding a coil around the outside of the box. The wire used was 30 gauge B & S enamel, the enamel being to insulate the turns one from the other.

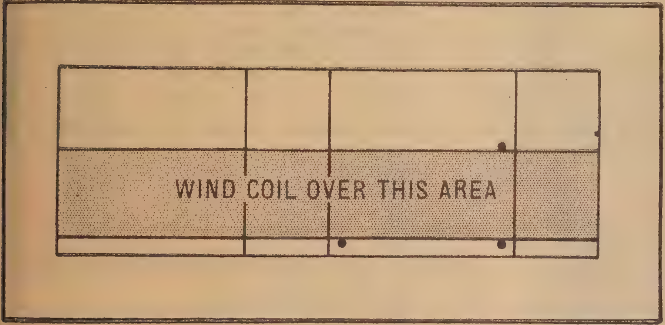
The gauge isn't very critical and if you use a different gauge of wire the only difference will be that the tuning range will be slightly different from the original. Some winding wire is insulated with cotton rather than enamel but this is quite in order, too.

We pushed holes ½in apart through the box with a pin to anchor the ends of the wire and another couple of holes about 1-8in outside the first two so that the wires could be twisted around and not come undone. This outer coil had 39 turns but if the gauge of wire is somewhere about right there is no need to count the exact number.

If the gauge of wire you use is greatly smaller or larger than 30 B & S enamel it would be best to count the number of turns as you wind them on making the pinholes accordingly even though the finished dimension may be different to ours. In other words, the number of turns has a greater effect on the characteristics of the coil than the length.



This diagram shows every connection in the set just as you will make it. It doesn't make any difference which way around you put the coils, the crystal or the capacitor or in which direction you make the windings.



The full sized template will save you the trouble of working out the size of the former for the inside coil. It can easily be copied on a piece of thin cardboard.

After you have wound the coil, trim the two wires to a length of 3in. and scrape off the enamel insulation 1in back from the end of the wire so that it can make good electrical contact. A knife or a razor blade can be used for this but a piece of sandpaper or emery cloth is better because there is less chance of nicking the wire and breaking it.

The inside coil is wound on a card former which is folded up from a piece of flat strip. The drawing we have made of the former folded flat is exact size and will save you working it out for yourself. Heavy paper would hardly be strong enough but there are plenty of food cartons with just the right sort of material.

The inside coil has a few more turns than the outside and the length should be about 5-8in. It can be terminated in much the same way as the outside coil except that the wires are brought to the end of the former nearest which the coil is wound. For other gauges of wire, the number of turns should be 48.

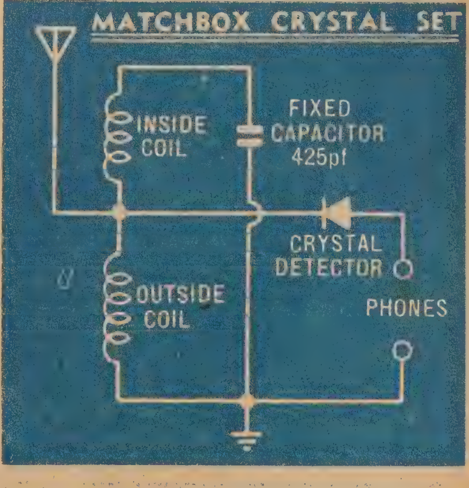
Trim the wires off, this time to about 2in long, and clean off some of the insulation in the same way as before.

Put the coil inside the tray of the matchbox so that the winding is in the centre and then try putting the box together. This is just to make sure that there is room and that the tray will slide without pushing the inside winding out of shape. If you have some cellulose tape, a couple of lengths around the outside of the tray and covering the wire may prevent the wire catching on the outside of the box and thus make it slide more easily.

The space at the end of the tray is to take the two other parts of the set being the crystal and the fixed capacitor.

The wires going to the aerial and earth, the headphones and outside coil are terminated on this same end of the box. Each termination can be effected by means of a pair of pinholes side by side.

For the details of all the connections we suggest you follow the diagram so that there is no possibility of making a mistake. So long as the



The schematic circuit diagram for the set. You don't need to understand it in order to wire up your set but it shows how symbols can be used to simplify matters.

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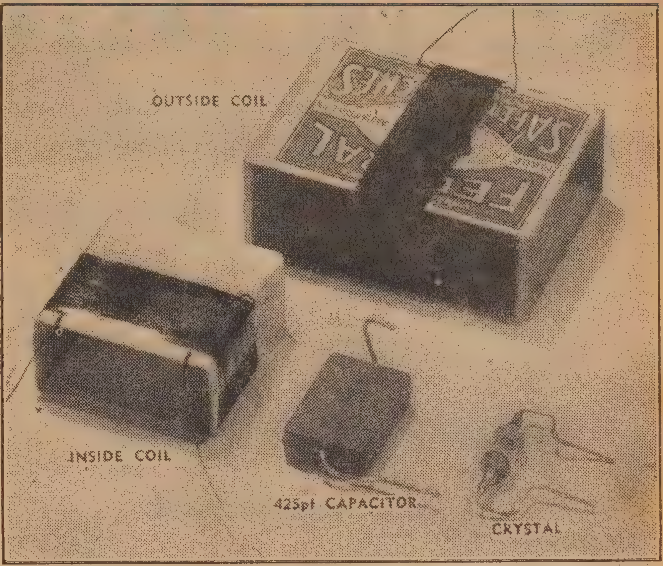
CRYSTAL RECEIVER COMPONENTS



Here are the parts for the crystal set before assembly. The inside coil is bound with cellulose tape to prevent the turns catching while you are tuning the stations. Wires for the capacitor and crystal should be bent approx. as shown

enamel, cotton or other insulation is removed and the wires firmly twisted together there is no need to worry about soldering. Similarly, the wires going to phones and to aerial and earth can be twisted.

In the early days of crystal sets, a crystal detector consisted of a piece of galena and a fine wire called a cat's whisker. This fine wire was adjustable in position and often an elaborate mechanical device was used for this purpose. The idea was to find the most efficient point on the crystal by experiment.

Unfortunately the old crystal detector was a somewhat unstable device and a bump was likely to upset the adjustment.

Modern crystal detectors are quite different. They are small sealed units which are adjusted when you buy them and will retain their adjustment in the face of almost any knocks and vibration short of that required to break the glass.

Modern crystal detectors are given type numbers in the same way as valves but for this set the subtle differences between various types are not so important and practically any type will do. A few suitable types which come to mind are the GEX33, GEX44, 1N34, OA50, OA60, &c. If you buy one new, ask the dealer for the cheapest type.

Crystals do have polarity but in this set it doesn't matter which way round they are connected.

A new pair of headphones is a fairly expensive item and not many young experimenters will want to buy a pair especially for this set. Of course, if you feel that you may use the phones for some other purposes then their purchase may be justified.

On the other hand, there seem to be dozens of pairs of phones around experimenters' workshops doing little but collecting dust so that if you make inquiries of your friends the chances are that you will be able to buy or borrow a pair with little difficulty.

SUITABLE HEADPHONES

In the days when phones were used a great deal they were usually described by their resistance. Common values were 2000 ohms and 4000 ohms, and either would be quite satisfactory for this crystal set. The main thing is that they be in good condition.

You can make a rough check by connecting the leads of the phones across a single 1½ volt torch cell. If the phones are in order there should be a sharp click when the connection is made or broken.

Disposals dealers may be able to supply you with phones for a few shillings but it is most likely that these will be of the low resistance type and although they will work, it is not likely that the signals will be very strong.

The difficulty can be overcome by using a transformer specially designed to match the low resistance phones to crystal sets and other high resistance devices. This takes away some of the novelty and simplicity of the little set but is a point to keep in mind if you are stuck for a pair of phones.

All the energy to work the headphones in the case of this little receiver is collected by the aerial which works in conjunction with an earth system. As you might imagine the amount of energy which is intercepted by a relatively small receiving aerial is not very great and if you are a long way from the station the signals may not be strong enough to be worthwhile.

DISTANCE FROM STATION

As a general rule it is considered that 15 miles is the maximum distance you can be separated from a station and still expect satisfactory results with a crystal set. Readers have sometimes written and told us of cases where good results have been obtained over greater distances but these are the exception.

In any case, the aerial should be as long and as high as possible. If you can find a couple of convenient poles or bulidings it can well be up to 50 feet long. The wire you use will depend on what is available but it need not even be copper. Any metal wire would work just as well for all practical purposes.

For a very temporary installation you could use the same wire as used to wind the coil for both the aerial and earth. The objection is that is is fairly fine and cannot be expected to last long in the wind.

Start at the most distant support and connect the aerial via an insulator. The usual porcelain insulators are fine but there are plenty of other materials which can be used to get the set working. For example, you could drill a couple of holes in each end of a bakelite strip or alternatively an old toothbrush handle cut in halves may make a couple of insulators.

The second insulator should be placed between the near end of the aerial and the support. A lead-in wire will come from the near end of the aerial down to the set. This may be the one unbroken wire from the end of the aerial to the set but if you have to make a join be sure to clean and twist the wires well because corrosion may make the connection poor after a short while.

The enamel insulation on the wire will not stand much rubbing which is the reason for using the insulators at either end. For the same reason it is desirable to provide some insulation for the aerial where it comes into the room to prevent it making electrical contact with the building.

You could use insulated wire for the last few feet of the lead-in or wrap some sort of insulation around the aerial at the critical points.

The set will not work without an earth wire. This is easier than the aerial because it does not need to be insulated. A water pipe makes an excellent earth and the idea is to clean away any corrosion which may be present and wrap the fine wire around it several times to make sure of a good connection.

If there is no water pipe handy a length of pipe or metal rod driven into the ground makes an excellent earth.

Don't get the idea that the little set does not work well. We made a direct comparison with a very elaborate crystal set and also with a simpler job using the conventional large diameter coil and variable capacitors and were agreeably surprised that the performance was by no means poor as crystal sets go.

(Continued on Page 53)

CRYSTAL INSERTS

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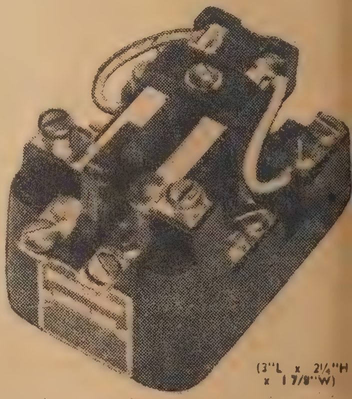
28302U		closed
28304U		open and closed
28306U	2	open
28307U		closed
28308U		open and closed
28311U	3	3 open
28312U		2 open — 1 closed
28313U		1 open — 2 closed
28314U		3 closed
28315U	4	4 open
28316U		3 open — 1 closed
28317U		2 open — 2 closed
28318U		1 open — 3 closed
28319U		4 closed
28325U	3	3 pole Change-over

OPERATING COILS

A.C. Voltage 50/60 cycles	D.C. Voltage
6	6
12	12
18	18
24	24
32	32
110	36
220	50
440	115
550	230

Sheet metal case available



(3"L x 2¼"H x 1 7/8"W)

Volts	Each Pole amps.	2 Poles in Series amps.	H.P.
110 A.C.	10	10	¼
220 A.C.	10	10	⅓
440 A.C.	5	5	⅓
115 D.C.	0.5	2.5	—
230 D.C.	0.3	0.5	—

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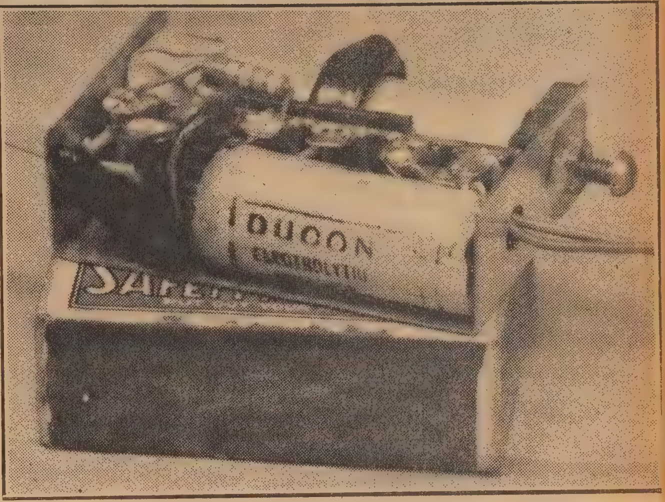
A TRANSISTOR AMPLIFIER FOR THE CRYSTAL SET



A matchbox amplifier for a matchbox crystal set is just the thing. The photograph shows how the component parts were fitted into tinplate tray of the same size as the original match tray.

A simple crystal receiver built around an ordinary matchbox is described elsewhere in this issue. This set inspired a member of our staff to work out a 1-transistor amplifier to make the signals louder. In order to match the set, the amplifier was also built inside a matchbox.

ONE of the main reasons for our describing the crystal set is that it costs next to nothing to build. Young chaps going to school can have all the fun of a radio of their own, and a very efficient one too, without mortgaging pocket money for months hence.

However, where money isn't so much of a problem, a very effective amplifier can be made with a transistor, a battery and a few other small parts. It may cost a couple of pounds or so, but at the same time you would get the crystal set plus transistor amplifier for less than a commercial crystal set and the results of the combination would be very much better.

Stations which can hardly be heard with the crystal set alone come up to listening level, when the amplifier is connected. When the stations are close together in frequency, selectivity can be improved by reducing the aerial coupling and the transistor amplifier can be used to make up for the loss in level.

Therefore, with the amplifier you stand to gain on two counts.

The physical form of the amplifier isn't important: there are no high impedance circuits to cause feedback problems with layout, nothing gets hot and the battery drain is so low that it will last for virtually its shelf life.

OUR MODEL

We show you how it can be fitted inside a matchbox, but, if you wish to lay the parts out on a piece of cardboard or in any other way, this will be quite in order.

The transistor used is the 0C71, a junction type which will work well on the single cell. As other transistors it has three connections being the base, collector and emitter. One of the first things you must do, therefore, is identify these.

We have provided a drawing looking at the end of the transistor from which the leads come showing just the connections. The key for identifying them is that the emitter and base are close together with the emitter on the outside and the collector apart from the others and on the outside. The collector side is also identified by a red dot.

We made up a tinplate tray the same size as the original matchbox tray, and mounted a six-lug tag strip down the centre. One of the lugs also supports the strip, and is soldered to the bottom of the tray.

The battery fits snugly in between the tag strip and the side of the tray.

At the positive end is a piece of bakelite about 3-16 inches thick and ½ inch square, with a hole to take the positive cap. This positive ca isn't high enough to make contac with the tinplate tray normally, bu by drilling a hole in the tinplate at this point and soldering a nu on the outside of the tray over the hole, a bolt can be screwed in with the fingers and act as a switch.

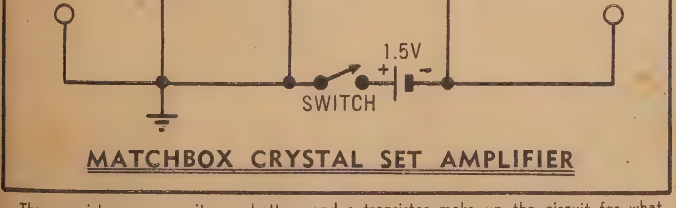
Most of the room on the opposite side of the tag strip is occupied by a 25 mfd capacitor with a ½ inch or so left for the transistor. The capacitor is an especially small type, which has recentl become available and is actuall smaller than previous units of hal the ratings.

TRANSISTOR IS DELICATE

Solder the transistor in according to the wiring diagram. The main thing to watch is not to allow the heat from the soldering iro to be conducted by the transisto leads and cause damage to the sensitive interior. As a matter of fac it is good practice to use a pai of long nosed pliers as a heat sink by holding each wire as it is soldered into place. There is no need to cut the wires short and in any case you may wish to use the transistor for another purpose at a late date.

The three resistors will have t be the new ½ watt types to fi in with our original layout, bu of course other types can be used if you don't want the matchbo layout. The same applies to th other components.

With the simple crystal set, th headphones must operate with th minute power received by the aeria but when you add the transisto amplifier it is actually the batter



Three resistors, a capacitor, a battery and a transistor make up the circuit for what seems to be the simplest amplifier ever published on these pages.

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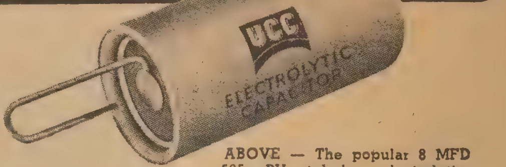

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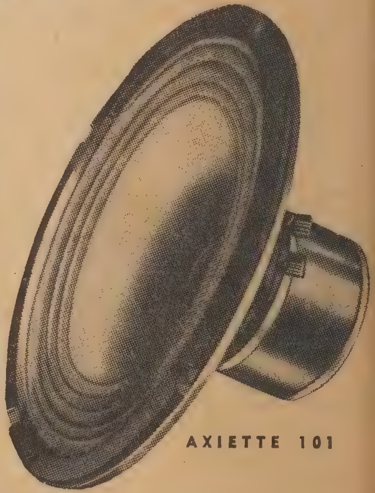

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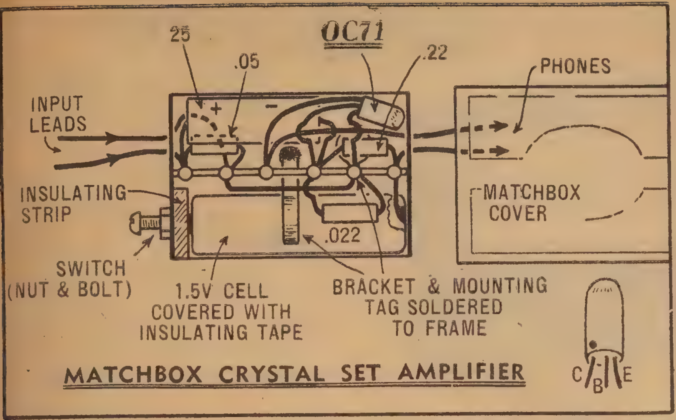
25
OC71
.05
.22
PHONES
INPUT LEADS
INSULATING STRIP
SWITCH (NUT & BOLT)
1.5V CELL COVERED WITH INSULATING TAPE
.022
BRACKET & MOUNTING TAG SOLDERED TO FRAME
MATCHBOX COVER
C B E
MATCHBOX CRYSTAL SET AMPLIFIER

This diagram shows how to place the components to fit them into a matchbox. For a tryout it would not be necessary to use such a compact layout and mounting the components temporarily on a piece of stiff cardboard would do just as well.

power which moves the diaphragm. The power from the aerial controls the collector current of the transistors and it is this current which works the phones.

For this reason the characteristics of the phones are not so critical and although high impedance types will give the best results, many low impedance types will work quite well. Even the ex-disposals' 45 ohm phones will give some results although the strength is very much lower than wtih more suitable types.

Incidentally, the measured no-signal current drain of the transistor amplifier is 0.4 mA at 1.5 volts, making the power input to the transistor only 0.6 milliwatts. Even if you happened to go off to sleep with the headphones on, it wouldn't matter very much. When the battery is finally exhausted—or deteriorates due to old age—it can be replaced for a shilling or so.

There may be a considerable reserve of gain with the transistor amplifier and if you live close to a station it may even be that the signals are too loud for comfortable listening. The strength can be reduced by detuning and this won't make the signal as obviously distorted as may happen with a selective superhet.

On the other hand, you can trade volume for selectivity by wiring a capacitor in series with the aerial. The smaller its value the better will be the selectivity and the less the volume. For a start you could try about 100 pF but if you have a very long aerial, 50 pF or even less may be necessary to give the desired results.

If you can find an old tuning capacitor, the selectivity can be made continuously variable. Most of these capacitors can be varied between about 10 pF and 300 pF or even more, so that you can have quite a range. Connect the aerial to the moving plates and the aerial terminal of the receiver to the fixed plate.

With the plates fully enmeshed, the selectivity and volume should be little different to the condition when the aerial is connected directly. However, when the station is tuned in you can decrease the aerial coupling by means of the capacitor until the selectivity is as good as required. The coupling adjustment will have some small effect on the tuning.

The addition of the transistor amplifier and the variable aerial coupling arrangement get away form the oiginal idea of a very simple crystal set but they are interesting things you can try. They apply equally well to any more advanced crystals sets or even small valve sets you may try later on.

The transistor amplifier can also be used with a small valve set by connecting the input leads to the phone terminals. However, the power output is quite small and you may find that it is not able to supply as much volume as the valve on the louder stations. We mention this latter application only in passing because the crystal set is the amplifier's main application.

MATCHBOX CRYSTAL SET

(Continued from page 49)

In one location in Sydney it was possible to tune the eight local stations, all except about two at good listening level. At another suburban location with an aerial only 30 feet long, four of the local stations were received at good strength and separated cleanly while there were traces of some of the others.

When you have identified the stations, their positions can be marked on the side of the tray so that you can tune to them accurately and quickly when required.

If the set is built according to the data we have given, you will find it to be quite selective. However, if you happen to live close to two very strong stations which are close in frequency you may find that it is not possible to hear one without the other.

The selectivity can be improved by connecting the aerial to the set via a small capacitor. The smaller the value, the better the selectivity but at the same time the volume will drop. We suggest you try 50 pF or 100 pF for a start. The longer the aerial the smaller the capacitor can be without reducing the volume too much.

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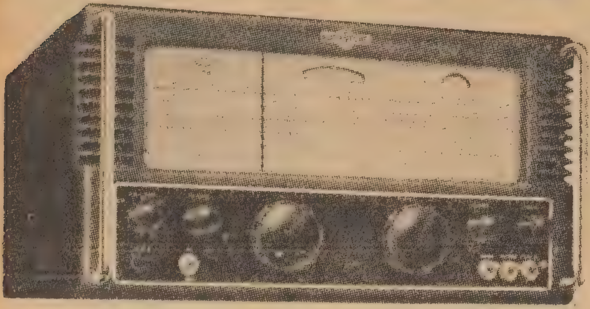

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FROM THE SERVICEMAN WHO TELLS

One case I had this month was one of those stupidly silly faults which can deceive by their utter simplicity. The other was just the opposite; a set with enough faults for half a dozen stories. Both, in their own way, have a moral.

THE fact that a serviceman is an efficient technician, equipped with the best test gear and facilities, does not automatically make him a good serviceman. The truth of this is emphasised quite forcibly by the following story.

It all started when a customer walked into the shop, handed me a 6AU6, and said, "I want another valve like that, please."

Now, I'm always extremely suspicious when an obvious layman makes such a request. Usually they have only a vague suspicion that there is something wrong with the valve, generally based on some irrelevant observation such as the color of the getter, inability to see the lighted filament, or even "feminine intuition."

It is really quite surprising the number of people who are prepared to waste money on a new valve, purely on the strength of such observations. In only about one pc of cases is there really anything wrong with the valve—and even then it's pure coincidence!

VALVE TEST

I find it good policy in such cases to suggest to the customer that I test the valve before he invests in a new one. Even though this generally means that I sacrifice the sale of a valve, I seldom lose in the long run.

The fact that I have advised the customer against an unnecessary purchase immediately wins his confidence. And since there is invariably something wrong with his set to have started the whole process, it is more or less inevitable that I should be asked to check it. In many cases such jobs are more profitable than the sale of a new valve and I usually finish up with a new customer.

So it turned out. I tested the 6AU6, found it quite normal, and asked the customer why he thought it was faulty. "It's the pickup thing," he replied. "I doesn't seem to have enough power. It gets the stations all right, but it won't play the records properly."

Assuming that these observations were correct it seemed likely that the trouble was anything but a faulty valve; more likely a faulty pick-up cartridge, particularly as we had recently experienced a bout of hot, humid weather.

A SAD STORY

In an effort to establish whether this might have been so, I inquired how long the set had been faulty. And then I was given the whole sad story. In view of what I subsequently discovered it was most significant.

Briefly, it seemed that the set had been stored for some twelve months while the owner's new house was being built. When installed in the new house—several months previously—the pickup had failed to perform properly and a serviceman had been called to fix it.

The set had been duly taken away, kept for several weeks, apparently given a complete overhaul and returned as being in first class condition. I was unable to discover what actual repairs, if any, were made to it, but a fairly substantial charge had been made for the overhaul and general handling involved.

But the pickup still refused to play properly, and this is where the owner made a serious mistake. Instead of contacting the original serviceman and demanding a satisfactory job—as he had every right to do—he let the matter rest for a while and then enlisted the aid of a friend who, on his own admission, knew only a little about radio.

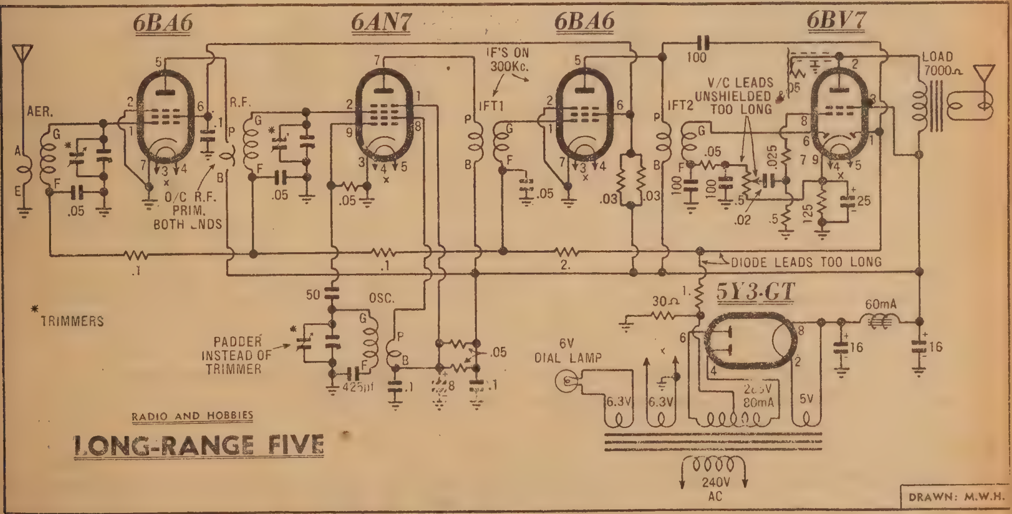
The friend suggested that the trouble could be either the 6V6 or the 6AU6, the valves comprising the audio circuit. Acting on this advice the owner had purchased a new 6V6, found it didn't help, and then approached me for a new 6AU6.

I decided that the hit-or-miss one-valve-at-a-time technique had gone far enough, and that it was time to find out what was really wrong.

A TEST RUN

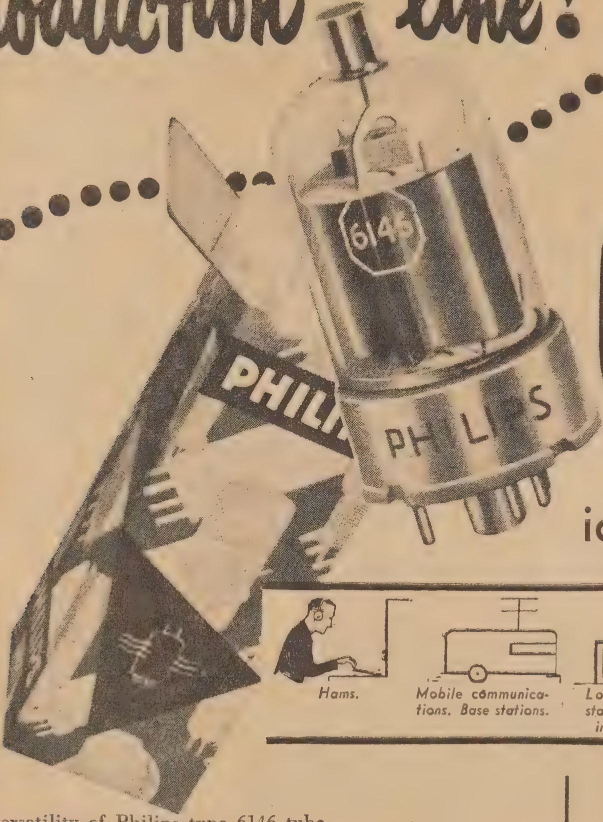
Frankly, I was rather intrigued by the story. I couldn't imagine any serviceman passing over a faulty pickup circuit, which was as bad as the owner claimed, yet something was obviously very wrong.

Accordingly I made an appoint-



Some idea of the faults I encountered in a home-made set is given by this circuit. Apart from the purely electrical faults there were several examples of poor layout. The over-long volume control and diode leads were particularly bad.

Hot off the production line!



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PV6-54

ent with the owner to examine e set later in the morning. I as particularly anxious to observe e exact conditions under which failed.

A couple of hours later I was hered into a spacious lounge- om and introduced to the offend- g radiogram. The family gath- ed round and a teenage daughter oduced a stack of records, adding at some appeared to be worse an others. (This was due to the nple fact that some were recorded ore heavily than others.)

The set appeared to be a normal ve-valve type such as forms the isis of most commercial radio- ams. First I tried it on radio. It emed to have ample gain, even ith less than 3ft of aerial hanging om the aerial terminal. When I abbed the aerial terminal the rength came up with a rush. I as willing to bet there was noth- ıg wrong with the chassis proper.

HANGE-OVER SWITCH

"Now let's hear the gram," I sug- ested. The teenager slipped a cord on the changer, pressed the arious knobs and lever, and oper- ted the Radio/Pickup switch on e set. The broadcast program anished, the changer went through s gyrations, and from the speaker ere came forth a woefully weak nd thin reproduction of the record. There was no doubt about it, mething was very wrong.

I checked the pickup connections the set, only to find that they ere wired directly into the chassis ith no pickup terminals. Through cut-out in the chassis I was able see the change-over to which the hielded pickup lead was wired. oping that there was no HT in the icinity I managed to get my finger rough the cut-out and on to the witch contact. This should have rought forth a healthy blurp from e speaker but instead had virtually o effect. Whatever the trouble as it appeared to be in the switch- g circuit rather than the pickup.

I moved the switch back to the roadcast position, then to the next osition, which should have been hort-wave. The next moment I vas searching frantically for the olume control as music from the ecord threatened to blast the cone ut of the speaker.

And that, believe it or not, was he simple explanation of the faulty ickup circuit. The user had been etting the selector switch to the vrong position!

NMARKED SWITCH

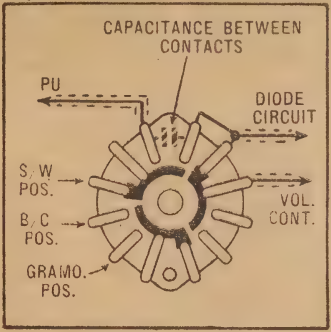
In turn this appeared to be due o three factors: (1) There were no narkings on the controls to indicate heir function or positions, (2) the isers had forgotten the correct 'Gram." position while the set was n storage, and (3) there was suf- icient capacitive coupling across the witch to give results of a kind when the switch was set to the hort-wave position.

In addition, I suspect, there was a ear that the set would be damaged f the switch was set to any position other than the supposedly correct ne, while the pickup was playing.

When the true story was fully ppreciated there was a deal of good natured chiacking between the members of the family, each trying to lay the blame on someone else for having suggested the wrong position. I stayed neutral, collected my fee (more or less a nominal one) and left.

I feel sure that the next time that person wants service of some kind I have a much better chance of getting the business than the previous serviceman.

To be sure he was quite correct in assuming that there was nothing wrong with the set and, I imagine he did a thorough job of overhauling it. But that does not absolve him from blame. Had he done his job properly he would have immediately questioned the owner when he was unable to find the fault of which the latter had complained.



Capacitance between switch contacts allowed some play through from pickup on all positions. The result completely confused the owner.

Most probably, as is so often the case, he had never even bothered to check exactly why the set was in his workshop, working on the basis of simply checking it over and correcting whatever faults were obvious.

Just how risky and misleading this approach can be is demonstrated quite forcibly by this story. On previous occasions I have dealt with this same subject, pointing out how intermittent faults, or faults peculiar to a set's location, can be completely over-looked. The result is customer dissatisfaction and a bad name for the serviceman.

A fundamental rule of good servicing, therefore, is to find out exactly why the customer has sought your service. Some are diffident and won't make any specific complaint unless questioned. Others will have difficulty in putting their complaint into strictly correct terms. But it's your job to stick with them and, by discreet questioning, obtain a true picture of the complaint.

ONUS ON MAKER

If they can't explain their problem in a manner you can understand try to examine the set in its normal situation and have them demonstrate the fault. But, whatever you do, don't start on the set until you know exactly what the customer wants corrected.

I make no excuse for "flogging" this subject. Full appreciation of it puts you half way to becoming a good serviceman. The other half—and it is only a half—is the technical training and experience you achieve over the years.

While considering this same case I think the set manufacturer must accept a portion of the blame. Surely it is not too much to expect established manufacturers to devise some means of marking controls in a manner which is aesthetically acceptable. In some cases the knobs themselves could be moulded or engraved with the necessary markings. In others a properly engraved panel would solve the problem.

I am reminded of a similar case which came to my notice some time ago. An elderly couple, who lived in an isolated spot many miles from the nearest serviceman, traded in their old and decrepit console, of early AC vintage, for a brand new mantel set.

All went well for a few weeks and they were very pleased with the new set. Then they had a visit from their son, his wife, and the grandchildren. After the visitors left the set refused to work, so the serviceman was duly called.

SIMPLE SWITCH

He couldn't come immediately and they had to do without their radio for two or three days until he could get around to that part of the district. When he arrived he looked inside the cabinet, checked the power plug, then reached for the volume control. A part turn, a click, and the set was working again. No one had bothered to explain to the couple that there was a power switch in the volume control!

Apparently the grandchildren, quite innocently, had fiddled with the knobs, leaving the volume control in the "OFF" position. Since there was no marking to indicate that such a facility even existed, the couple were both denied whatever convenience this may have afforded them and caused considerable inconvenience when it was incorrectly used.

As a contrast to these sublimely simple faults my next case was a real headache. It was a home-made version of the Radio and Hobbies Long Range Five—and not a particularly well made version at that.

In the normal way I am not particularly keen on such efforts. Some can amount to a virtual rebuilding job, and there is always the risk that, in trying to make a good job, one may run the owner into more cost than is justified.

BORDER-LINE CASE

I finally decided that this was a border-line case which I could probably tackle on a spare time basis. Had the wiring been any worse, I would have told the owner to take it home and rewire it, then bring it back to me if it still needed attention. As it was I could see where most of the wiring corrections would have to be made.

Another factor which influenced me to take it on was that I was running short of interesting copy for this issue and such sets usually contain at least one unusual fault. (At least one? Brother, had I only known!)

According to the owner, the performance was very poor. This was confirmed when the set was tested on the bench, only three local stations being audible and these being crowded toward the low frequency end of the dial. There was also a strong morse signal which could

Ferguson

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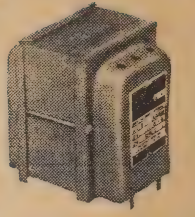

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PF 130F	230-240	285	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 151	230-240	285	60	6.3V/2A 5V/2A
PF 151F	230-240	285	60	6.3V/2A 5V/2A
PF 152	230-240	285	125	6.3VCT/2A 6.3V/2A 5V/2A
PF 165	230-240	385	60	6.3V/2A 5V/2A
PF 170	230-240	285	80	6.3V/2A 6.3V/2A 5V/2A
PF 185	240	150	30	6.3V/2A
PF 201	240	225	50	6.3V/2A
PF 265	230-240	Secondary Volts		17 TAP 11.5, 10. 8.5/4.2A
PF 299	240	285	40	6.3V/2A 5V/2A

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PF 160	230-240	385	100	6.3V/2.5A 6.3V/2.5A 5V/2A
PF 164	230-240	325	100	6.3VCT/2A 6.3V/2A 5V/2A
PF 166	230-240	325	60	6.3V/2A 5V/2A
PF 168	230-240	385	80	6.3V/2A 6.3V/2A 5V/2A
PF 169	230-240	325	80	6.3V/2A 6.3V/2A 5V/2A
PF 173	230-240	425	175	6.3VCT/3A 6.3V/2A 5V/2A
PF 174	230-240	285	150	6.3VCT/2A 6.3V/2A 5V/2A
PF 175	230-240	385	150	6.3VCT/2A 6.3V/2A 5V/2A
PF 545	240	Ext. 1000	2	6.3V/3A 6.3V/6A
		350	20	4V TAP 2.5/2A
PF 439	240	32V	60	240-32 STEPDOWN

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CODE No.	HY IND.	D.C RES.	D.C MA
CF 102	15	300	60
CF 103	30	420	60
CF 105	15	250	80
CF 109	20	225	150
CF 196	20	130	125

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CODE No.	HY IND.	D.C. RES.	DC MA
CF 106	12	200	100
CF 111	16	165	200
CF 112	10	70	250

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OP 13	25	10,000, 6600, 5000 PP	500, 250 125		50-8000 C/S
OP 24	5	5000 SE	8.4 OR 2.1		30-15,000 C/S
OP 25	15	10,000 PP	15-3.7 OR 8.4-2.1		20-30,000 C/S
OP 44	10	5000-2500 SE	500, 250 125		50-8000 C/S
OP 54	10	5000-2500 SE	15, 12.5, 8.4, 6.5, 4, 3, 2.7 2.3, 2.		50-8000 C/S
OP 58	15	10,000, 6600 5000 PP	15, 12.5, 8.4, 6.5, 4, 3, 2.7, 2.3, 2.		50-8000 C/S
OP 63	15	10,000 PP	15, 3.75		30-15,000 C/S
OP 112	6	10,000 PP	2, 8	SUIT ROLA 12 OX	40-12,000 C/S
OP 113	6	5000 SE	2, 8		40-12,000 C/S
OP 118	6	8000 PP	2, 8		40-12,000 C/S

OUTPUT TRANSFORMERS SECOND PREFERENCE

CODE NO.	WATTS	PRIM Z	SEC. Z	RESPONSE
OP8M	15	10,000 PP	500, 250, 160, 125, 100, 83.5, 75, 62.5, 55, 50	50-8000 C/S
OP 17	32	10,000, 6600, 5000 PP	500, 250,125	50-8000 C/S
OP 19A	15	5000 PP	12.5, 8, 2.3	30-15,000 C/S
OP 65	15	10,000 PP	8.4, 2.1	30-15,000 C/S
OP 67	15	5000 PP	15, 6.5	20-30,000 C/S
OP117	6	5000 PP	8, 2	40-12,000 C/S
OP119	6	6600 PP	2, 8	40-12,000 C/S
OP 60	32	10,000, 6600, 5000 PP	15, 12.5, 8.4, 6.5 4, 3, [illegible], 2.7, 2.3, 2.	50-8000 C/S

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VT 104	6	250	60	.004
VT 210	12	250	60	.006

VIBRATOR TRANSFORMERS SECOND PREFERENCE

CODE NO.	PRIM VOLTS	D.C. VOLTS	O'PUT MA	BUFFER FULL SEC.
VT 116	24	250	60	.005
VT 208	6	250	60	.01
VT 209	12	250	60	.08
VT 211	32	250	60	.005 ea. half

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TELEPHONES
JA 8491 (6 LINES)

Engineered TODAY for TOMORROW'S requirements not be tuned out, suggesting that it was being received by the IF channel. Altogether the alignment appeared to be in a very bad way.

A voltage check revealed correct HT and the audio section appeared to be functioning normally. The first requirement appeared to be the alignment of the IF channel.

This provided two surprises. First, it turned out to be tuned to approximately 300 Kc, a fact which suggested the possible reason for the morse interference and the generally poor performance. I confidently expected that, having corrected this error, I would have some sign that I was "getting somewhere".

This was surprise number two. Re-aligning the channel to 455 Kc seemed to have very little effect, except that it cured the morse interference. It did shift the stations a little on the dial, but they were still nowhere near where they should have been. The overall sensitivity may have been improved, but not noticeably so.

TUNING ADJUSTMENTS

Another puzzling fact was the behavior of the various aerial and RF tuned circuit adjustments. Adjustment of these seemed to have virtually no effect. The oscillator trimmer also refused to behave in a normal manner, being capable of shifting the station calibration by only a small amount. Altogether the front end behavior was just plain silly.

It was while I was fiddling with the oscillator trimmer that I noticed it was slightly different in appearance from the aerial and RF units. At first glance all three appeared to be similar, the moulded bases having obviously come from the same mould and the metal parts from the same press. What caught my eye was what appeared to be a slightly thicker assembly of plates. A closer examination confirmed my suspicions; the "trimmer" wasn't a trimmer at all, it was a padder.

Considering that a padder has roughly 10 times the capacitance of a trimmer, plus a limited range of adjustment, it was little wonder the set refused to behave.

Substituting a real trimmer cleaned things up considerably. Stations began to appear somewhere near their correct markings, could be shifted in a normal manner, and sensitivity was improved.

STILL SHORT

But, though improved, it was still a long way short of what it should have been for a set of this type. Also, I suspected, I was not going to be allowed to bring it to a state of maximum sensitivity without signs of instability. There were several points about the wiring which I considered would need to be corrected. Just as a matter of interest I decided to see how far I could go before the thing screamed for mercy.

First I tackled the slug in the RF coil, only to discover that the threaded brass rod was bent and that it was impossible to turn it more than half a turn or so before it jammed. Furthermore such attempts produced violent intermittent oscillation and a general impression that something was temporarily "coming good" inside the RF coil.

Checking the plate voltage on the RF valve confirmed this. For the most part it was non-existent, but appeared erratically for a few seconds as the slug was rotated back and forth. It seemed logical to suppose that the layout of the set was such that the gain provided by the RF stage—even before it was aligned—was more than could be handled. Hence the violent oscillation every time the plate circuit was closed.

I removed the coil and opened it for inspection. The story it told was quite intriguing. Main cause of the bother was the bent slug. This had jammed in the bushing so effectively that somebody's previous attempt to adjust the slug had only succeeded in loosening the entire coil assembly and rotating it sufficiently to break the lead to the plate pin.

To cap it all, the other end of the winding—terminating on the B plus pin—had never been soldered to this pin, simply wrapped tightly around it.

I can just imagine the lovely intermittent that would have caused, had it not been discovered.

Repairing the winding did not present any great difficulties, but I took the precaution of removing the slug before I started on it. It was not so badly bent that I could not unscrew it when I was able to hold the bush firmly with a pair of pliers.

THREAD REPAIR

The coil repaired, I considered the slug. I probably had a similar slug in a discarded coil somewhere, but it could well take time to find it. Reasoning that there was nothing to lose, I decided to try straightening it. Sandwiching it between two pieces of soft wood, I gripped the combination in the vice, made sure that the bend was suitably set, and applied the pressure.

It worked like a charm. The wood was too soft to harm the delicate thread, yet was able to apply enough pressure to correct the bend. When fitted back into the coil it worked quite smoothly.

Then I wired it back into circuit, switched on—and the real fun began. As I had expected, the layout errors were making their presence felt. The set was hopelessly unstable; violently so, creating the impression that it would never be anything else.

First point was the volume control leads. For some reason the builder had elected to transpose the volume control and tone control positions, thus increasing the length of lead between the volume control and the second IF transformer.

This in itself might not have been so bad, but he had used unshielded wire and run the leads around the edge of the chassis—rather than the more logical diagonal path—past the IF amplifier socket, the converter socket, and the RF amplifier socket.

This arrangement could cause instability in two ways. First, there is always the chance that some IF signal will be present in the volume control circuit, in spite of RF filtering to remove it. Even if it is only a very small amount, it could easily be sufficient to spill things over if coupled into, say, the grid of the IF amplifier.

Secondly, and I suspect that this was the major cause in this case, there is the chance that the volume control leads will have IF signals fed into them from the plate of the IF amplifier. These would be amplified by the audio system, even if not very efficiently, and appear in the output plate circuit and loudspeaker leads. From here they could easily couple back into the early stages of the set.

To support this latter theory was the fact that the RF probe of the signal tracer was able to detect very strong IF signals when placed in close proximity to the speaker and output leads.

LEAD PLACEMENT

Anyway, whatever the reason, I felt that things would be much better with the leads sheltered and reduced to a more logical length. Strictly speaking, the position of the two controls should have been transposed back into their correct positions, but I decided that it would be sufficient to rewire the volume control. At least, I reasoned it was worth a try. Time enough to go to the trouble of changing them over when all else failed.

The tone control leads looked harmless enough so I concentrated on correcting those to the volume control. The difference this made

(Continued on Page 103.)

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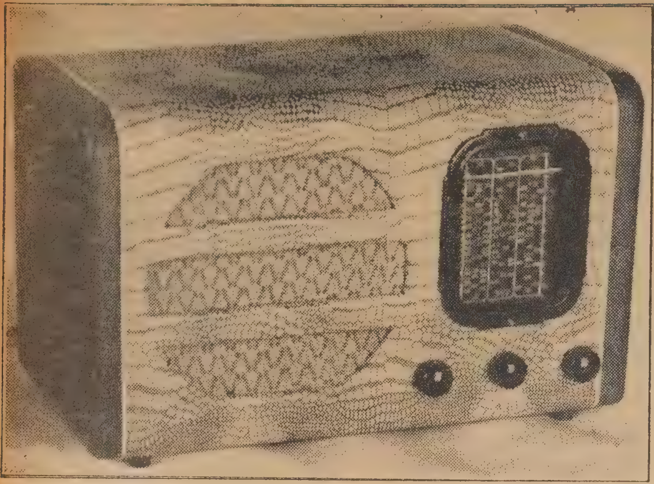


The completed receiver in its cabinet. The type shown in the photograph above was orginally designed for a comparatively old design known as the Fireside Five, and achieved considerable popularity. In practice any design of cabinet may be used, and it is not hard to make one yourself from ply-wood, finishing it either in imitation leather glued to the wood or by lacquering the bare cabinet to any desired shade or combination of colors.

A MANTEL SET FROM OLD PARTS

Perhaps, over the years, you've accumulated a boxful of bits and pieces. Here's your chance to assemble them into a complete set, which will be just as glamorous or just as functional as the finish you give to the cabinet.

WE'VE already set the style for this receiver with our two Basic Five" designs in previous is- ues.

However, these two sets were in- ended primarily for use in console abinets and no attempt was made ɔ limit the dimensions of the hassis.

In the "Basic Four", described ere, the chassis dimensions have een reduced and the whole layout ıodified to suit a "mantel" style of abinet.

ARGE COMPONENTS

At the same time, we have de- berately used the older style valves ıd components throughout, be- ause these are the ones readers are ıost likely to have on hand. An dd, small component can always be sed in place of a large component -but the reverse isn't always pos- ble.

Either way, provided you don't se components that are decrepit ıuseum pieces, the performance ill be completely satisfactory.

As a general rule, full-sized coils few years old will be at least as ood as modern miniature types, if nly because it is easier to make good coil when space isn't at a emium.

The same is true of IF transformers.

Even the more ambitious ratings of miniature valves are of secondary importance for broadcast reception. The advantage of their higher transconductance, lower capacitance and shorter internal leads does not become really evident until they are used in shortwave, FM or television receivers.

PROS AND CONS

However, we didn't set out in this article to debate the pros and cons of new and old-style components; of miniatures and monsters.

The former might be preferred for several reasons for a new design, but this isn't intended as such. It's a circuit and a layout, which you can adapt to use up odd parts or to rebuild an existing set.

The most popular, and just about the only worthwhile circuit for a mantel receiver is the superheterodyne and, for local listening, four valves are quite adequate.

by L. Varady

The circuit has been kept simple deliberately, to enable a wide variety of valves and components to be used.

Its principle of operation is so well known, that we need not go into detail about it here. However, the possibility of using alternative valves, transformers and loudspeakers is an important matter from the economic side, and warrants detailed discussion.

NECESSARY STAGES

The four valves used have the following functions: Converter, IF amplifier and second detector, output, and rectifier.

Consider first the converter. One of the most widely used converter valves before the advent of miniature types was the 6J8 (G or GA). We have shown this type in our circuit diagram. It requires a plate voltage of 200 to 250 volts, a screen voltage of about 100 and a grid bias of minus three volts.

Fortunately, these values are fairly typical for converter service, and a look in the valve lists reveals that there are a number of similar types which will operate satisfactorily under these conditions.

One such valve is the 6K8, which has identical connections, and, although it draws more screen current, it can be accommodated in the present circuit without need for any alterations.

Among the triode-hexode converters, the Continental types ECH3, ECH33 and ECH35, were also widely used. Their operating conditions are also very like those of the 6J8, except that the minimum bias specified is minus 2 volts. The slightly higher bias provided in the present circuit is of little practical consequence.

EARLIER TYPES

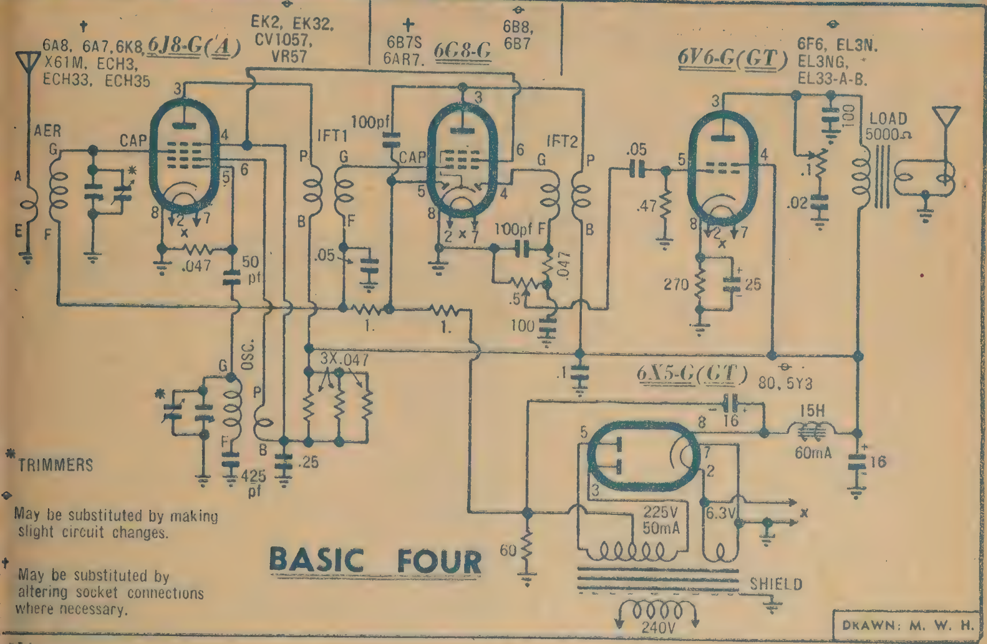
The earlier types 6A7 and 6A8 should also operate satisfactorily without any alteration to the operating conditions.

Even the old 2A7 could be used, if a 2.5 volt heater supply is available.

The continental EK2 and EK32, as well as the service types 1057 and VR57 pentagrid converters are other possibilities. These valves, however, require a screen voltage of 50 only, and a screen dropping resistor and bypass capacitor will have to be added to the circuit, as indicated on the auxiliary diagram.

Lastly, the X61M, a fairly recent valve, can be used under conditions

CIRCUIT ALLOWS WIDE CHOICE OF COMPONENTS


6A8, 6A7, 6K8, X61M, ECH3, ECH33, ECH35
6J8-G(A)
EK2, EK32, CV1057, VR57
6B7S 6AR7.
6G8-G
6B8, 6B7
6V6-G(GT)
6F6, EL3N. EL3NG, EL33-A-B.
AER
A
E
G
F
CAP
IFT1
100pf
IFT2
P
B
.05
.47
LOAD 5000Ω
.1
.02
100
.047
50 pf
1.
.5
270
25
3X.047
OSC.
6X5-G(GT)
80, 5Y3
15H 60mA
16
425 pf
.25
225V 50mA
6.3V
x
60
SHIELD
240V
*TRIMMERS
May be substituted by making slight circuit changes.
May be substituted by altering socket connections where necessary.
BASIC FOUR
DRAWN: M. W. H.

o special tricks have been employed in this circuit to make it adaptable. Alternate valve types for each stage are shown.

cified for the 6J8.

he socket connections given in the uit apply to the 6J8, 6A8 and , but may have to be altered for er valves.

ur choice of IF valves is rather ted. A remote cutoff duo-diode-tode is really required here, to w the valve to be controlled ef-ively by the AVC.

wo electrically identical valves, 6G8 and its earlier counterpart, 6B7S can be used, the latter uiring a 7-pin socket. Alterna-ly, the more modern 6AR7-GT be employed without circuit ige.

edium cutoff pentodes, such as 6B7 and 6B8 could be substi- in that position, but they must operated with a separate screen ping resistor. This allows the en voltage to rise substantially, n the AVC voltage is applied, thus avoids the abrupt cutting of plate current, when a cer- level of grid bias is reached. eparate screen bypass capacitor, dicated on the auxiliary circuit, be required.

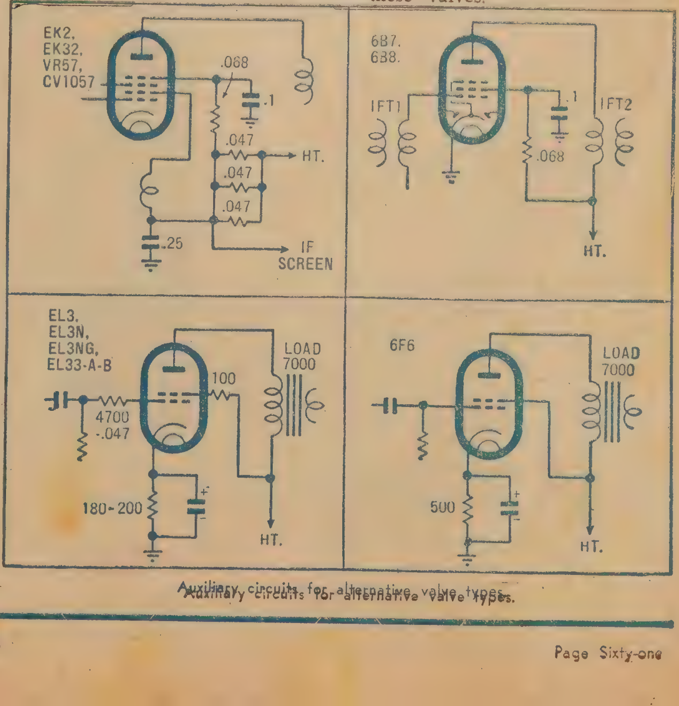
he same remarks apply for the type 2B7, if you should want e one.

e of the most obvious choices the output stage is the 6V6 tly overbiased, and with a plate screen voltage of about 220, this e still produces an output of 2 s, which is sufficient for most cation. At the same time, its nt requirements are reduced to over 35 ma, allowing it to be eniently accommodated within a HT drain of 50 ma for the re-r.

Of the alternative types the 6F6 could be considered, though it requires a 500 ohm bias resistor to keep its current drain within the circuit ratings. Its plate load should be 7000 ohms, but this value is not at all critical.

The 2.5 volt type 2A5 would come into this same category.

Some of the high-gain Continental types, such as the EL3, EL3NG, and the EL33 (A or B) would also be suitable. Bias resistor values of 180-200 ohms provide sufficient bias for these valves.


EK2, EK32, VR57, CV1057
.068
.1
.047
HT.
.047
.047
.25
IF SCREEN
6B7. 6B8.
IFT1
IFT2
.1
.068
HT.
EL3, EL3N, EL3NG, EL33-A-B
LOAD 7000
100
4700 -.047
180-200
HT.
6F6
LOAD 7000
500
HT.

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DEFLECTION COMPONENTS

Those illustrated are typical of the ones we shall supply. The Horizontal Line Output and E.H.T. Transformer (see A). This unit's function is to drive the horizontal, or line, deflection coils and to furnish a final anode voltage of 14 K.V. to the picture tube. The Vertical Output Transformer (see B) is similar to an audio output transformer and drives the vertical deflection coils. The Deflection Yoke (see C) fits over the neck of, and hard against, the cone of the picture tube. It incorporates the vertical and horizontal deflection coils. Their combined influence upon the electron-beam within the picture tube, causes the transmitted image to be reproduced upon the face of the picture tube.

The Unit (see D) contains the Horizontal Width Control Coil and Horizontal Linearity Control Coil together with their associated circuit components. Focusing Rings (not shown) will also be available. Ion Traps will normally be supplied with the picture tube. Video and Sound I.F. Transformers will be made available either in a grouped kit or ready made up on completed and tested strips.

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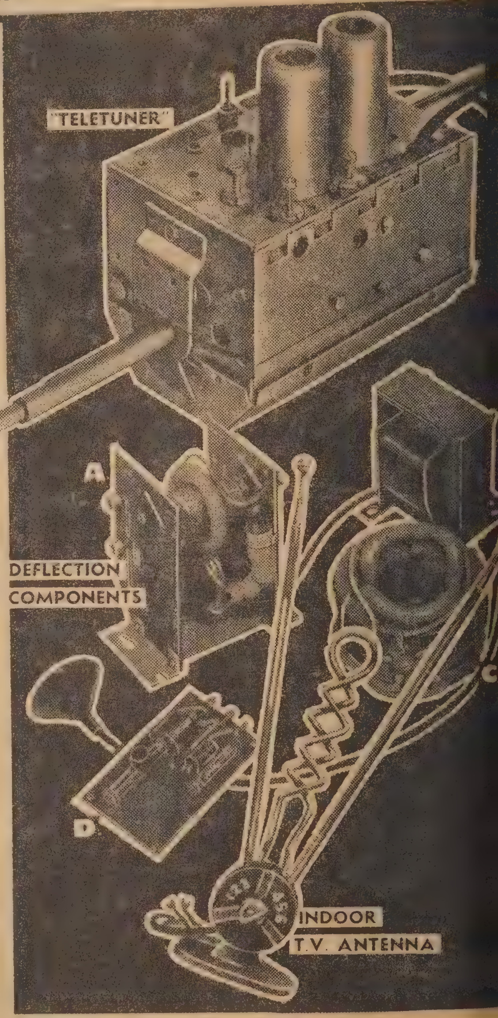

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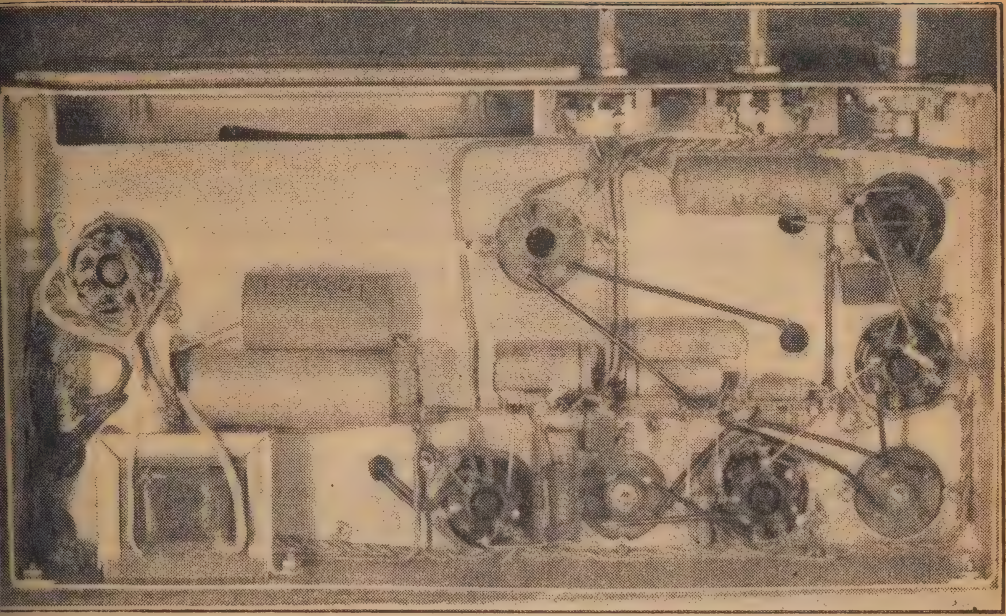
FRONT AND UNDERNEATH VIEWS OF THE CHASSIS



Point to point wiring was used in this set. Only a few components need support by tagstrips.

In common with other high gain ypes, precautions will have to be aken to prevent parasitic oscillation a these valves. A 100 ohm screen opper and a grid stopper of between 700 ohms and .047 meg. should be ufficient. (See auxiliary circuit.)

The three stages of the receiver reuire a HT of about 220 volts at a rain of 50 ma. This is within the atings of the smallest transformer kely to be encountered in mantel ets a 225-volt, 50-milliamp type.

The type and size of power transormer will govern the choice of the ectifier. The transformer just menoned has only one filament winding ated at 6.3 volts 2A, so that only on adirectly heated rectifier, such as he 6X5 can be used with it. We have hown this combination on the ciruit diagram.

HE RECTIFIER

Transformers with current ratings 0 mA or higher provide a 5V windg for directly heated rectifiers, llowing the use of such valves as he 80, or its more modern counterarts, the 5Y3. Of course, a 6X5 ould still be used, simply by ignorg the 5V winding.

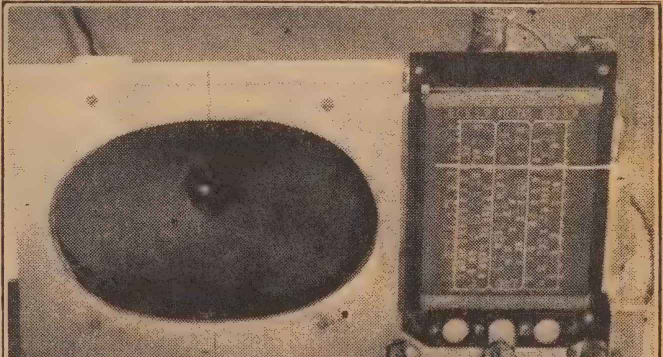
This brings us to the question of e power transformers likely to be vailable. The ideal is undoubtedly e 225 V 50 mA type, because of its onvenient rating and small physical ze. However a 285 or 385 V 60 mA pright transformer could be accomodated on the chassis as it stands. may be necessary to enlarge the assis for flat types.

Lastly, suitable loudspeaker types. he chassis allows for loudspeakers to 6in diameter, or a 5-7in oval. naller speakers could be fitted, if so desired, but it must be pointed out that, even with mantel receivers, 5in speakers would be the smallest practicable.

Electrodynamic speakers would be practicable, provided that the transformer is capable of delivering adequate voltage after energising the field coil. The only limitation is that some types of 6in electrodynamic speakers may be too large to fit on the chassis together with the larger power transformer required. Here again, it may be necessary to expand the chassis somewhat.

Transformers giving higher voltage than specified in the circuit can be used, provided that a resistance is inserted in the cathode lead of the rectifier to drop the voltage. Against this the extra voltage may come in handy if an electrodynamic speaker is to be used. Resistance values for the more usual transformer voltages are given in a separate diagram, which also shows where to connect the field coil of the speaker.

From the constructional point of view, the first question that comes to mind is that of the cabinet. In view of the popularity of one particular cabinet which has been used



Front view shows dial mounting and loudspeaker baffle.

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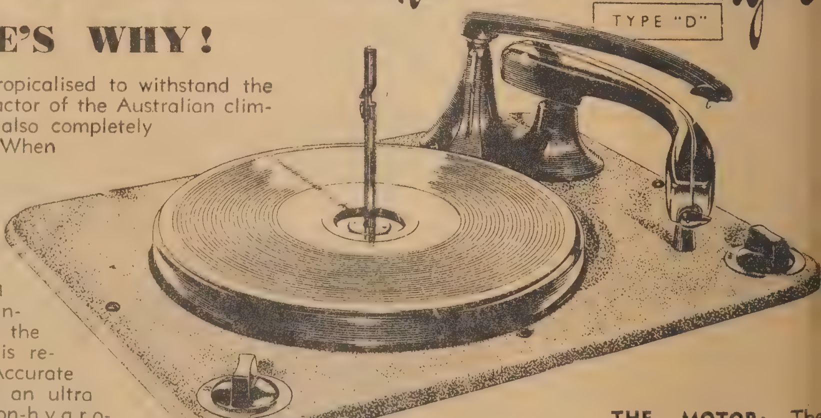

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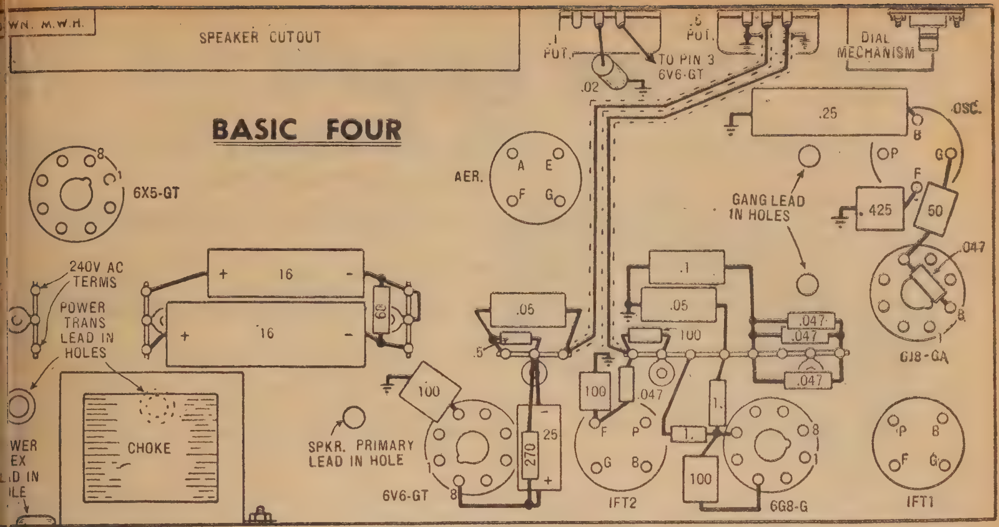

WN. M.W.H.
SPEAKER CUTOUT
.1 POT.
TO PIN 3 6V6-GT
.02
.5 POT.
DIAL MECHANISM
BASIC FOUR
.25
OSC.
B
OP
G
F
6X5-GT
AER.
A
E
F
G
GANG LEAD IN HOLES
.425
50
.047
240V AC TERMS
POWER TRANS LEAD IN HOLES
+ 16 -
+ 16 -
60
.05
.1
.05
100
.047
.047
.047
8
1
6J8-GA
.5
100
WER
EX
.D IN
ILE
CHOKE
SPKR. PRIMARY LEAD IN HOLE
6V6-GT
1
8
270
25
100
.047
F
P
G
B
IFT2
1
1
100
8
1
6G8-G
P
B
F
G
IFT1

This diagram will help you to place minor components.

everal earlier mantel sets ("Fire- Five", "Long Range Five" and DX Mantel") we decided that would be little point in design- new cabinet.

ain, if reconstructing an old re- r, the original cabinet might do as well.

cordingly we made up the chas- o fit into the "Fireside Five" et. The chassis measures 12 x 1¾in and has two cutouts along front edge to receive the loud- er and the dial mechanism be- the usual mounting holes for es, coils etc.

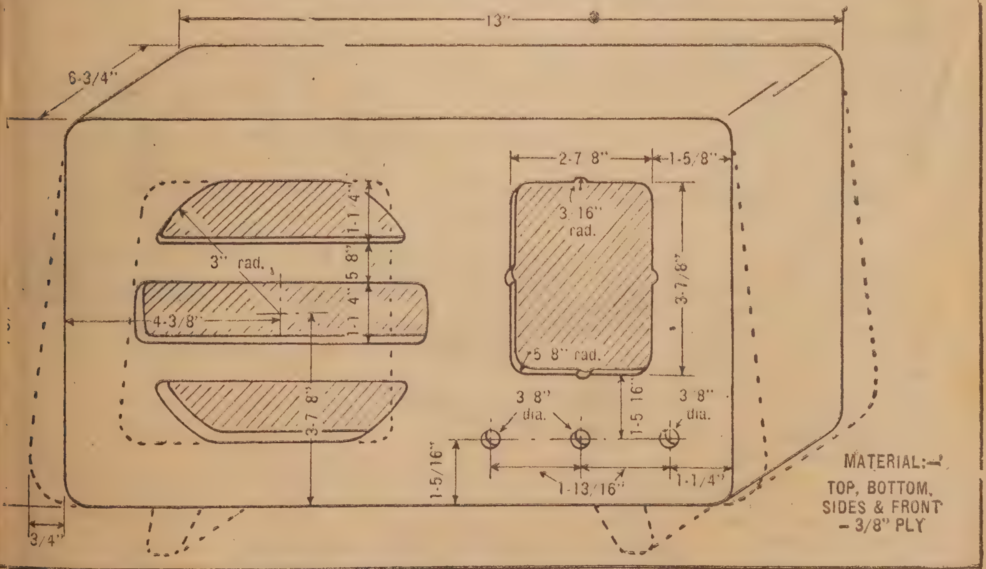
mentioned earlier, several different types of speakers can be used with this set, and the actual cutout will have to be modified to suit the particular type chosen. We selected a 5-7 in oval speaker and made the cutout to suit.

When mounting the loudspeaker, it would be wise to place a baffle board of ¼in ply in front of it. The dial protrudes from the chassis, and when the set is placed in its cabinet, there would be a gap left between the cabinet and the edge of the speaker. This would affect the low frequency response. The baffle board fills in this space and prevents any trouble arising. The shape of the baffle can be seen from the photograph.

The position is quite different with the dial. At present only one dial type is available for mantel sets, the USL 21, and even this one will need some minor modifications to make it suitable for our purpose. Unless you have a suitable dial on hand, it will be necessary to obtain this item new, and modify it.

To mount the dial, the drive spindle is removed from the backing plate and fixed in the cutout on the chassis, in line with the other controls. The dial plate is fixed to the chassis just above the line of

CABINET DETAILS FOR BASIC FOUR


13"
6-3/4"
1-1/4"
3" rad.
5/8"
1-1/4"
4-3/8"
3-7/8"
2-7/8"
1-5/8"
3/16" rad.
3-7/8"
5/8" rad.
3/8" dia.
3/8" dia.
1-5/16"
1-5/16"
1-13/16"
1-1/4"
3/4"
MATERIAL:—
TOP, BOTTOM, SIDES & FRONT — 3/8" PLY

A handyman can easily make up the cabinet from this drawing. Dotted lines show alternative design.

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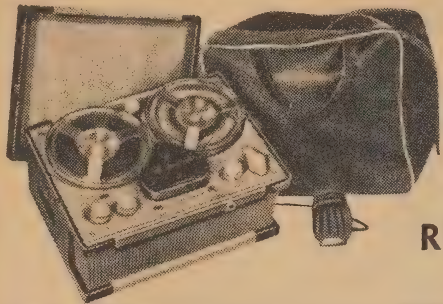

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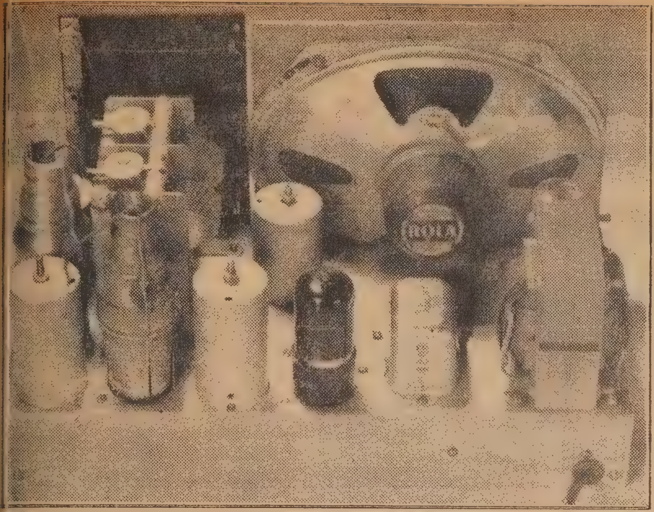


here is not much spare room in this layout, but "G" type valves with shields will easily fit.

trols, allowing sufficient room for locking nuts. It may be neces- y to trim the corners of the plate h a file for a proper fit.

Vhen the tuning gang is put into ition, the dial will have to be re- ung according to the diagram ther on.

ooking at the chassis from the nt, the components for the re- ver proper are placed behind the l on the right hand side of the ssis, while the left hand side is upied by the loudspeaker and the ver supply.

he tuning gang is mounted straight ind the dial plate, leaving just ficient room on the edge of the ssis for the oscillator coil, con- ter valve and 1st IF transformer. h standard size AWA or Strom- g H gangs the spindle will have to cut back to about ½in and the g mounted well forward to allow IF amplifier valve to be put nt behind it.

he second IF transformer and the put valve are placed along the r edge of the chassis in line with IF valve, while the aerial coil accommodated to the left of the g, with just sufficient clearance the moving vanes.

On the left hand side of the chassis, behind the loudspeaker, you will find room for the rectifier valve, and the power transformer on the rear corner. Any but the largest output transformers can be fitted between the power transformer the output valve and the magnet assembly of the speaker.

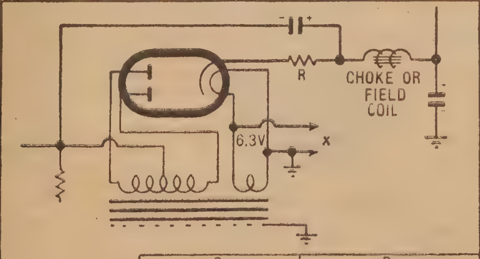
As pointed out, upright transformers up to 60mA ratings can be accommodated on the chassis with permanent magnetic speakers. If the loudspeaker has a larger magnetic assembly than usual on the speakers listed, as with some of the older electrodynamic speakers, or if the transformer is extra large, or one of the horizontal types, there is nothing for it but to extend the chassis by about an inch or so, and modify the cabinet accordingly.

While the details of the "Fireside Five" cabinet are given elsewhere in this issue, you might like to design your own cabinet, perhaps something in the line of the Kloxette cabinet. This could easily be made to accommodate a larger chassis, but being narrower on the top than at the bottom, it has the advantage of not looking quite as bulky as an equivalent rectangular cabinet.

☆

is how the drop- resistor is d, if the voltage oo high. Diagram s values for usual ages.

☆



	R WITH PERMAG. SPEAKER	R WITH ELECTRODYN. SPEAK. 1500 F.C.
285V TRANS	1150 ohms 5W	- - - - - -
385V TRANS.	2200 ohms 5W	850 ohms 3W

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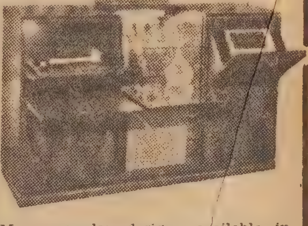

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SYDNEY
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BUILD A—
UNIVERSITY
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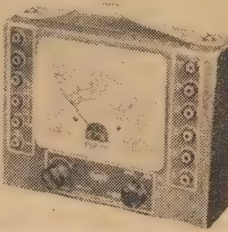
The MKI kit is complete to the last screw and includes the latest model clear plastic cased meter. An instruction booklet fully covers all aspects of the construction which only requires two or three hours time. The finished instrument is the equal of any make costing up to double this price.

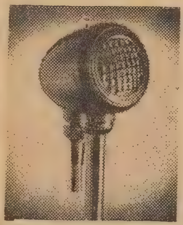
The ranges are: —
Volts DC-AC & OP. 10; 50; 250 and 1000 volts.
Milliamps DC. 1; 10; 50 & 250.
Ohms: High and Low ranges.

£12/18/9



There is also a companion instrument kit in a matching metal case, the OK1. From this can be constructed an efficient oscillator with pre-aligned coils covering the IF; BC and SW ranges. The price is also £12/18/9.

THE BEST IN CRYSTALS
RONETTE
MICROPHONES & PICKUPS



Model B110 Microphone (illustrated) is an inexpensive but efficient unit housed in an attractive cream plastic case. Can be used in the hand or mounted on a stand. Ideal for Tape Recorders; Amateur Stations and general uses.

£3/19/7

Other models available. **Write** for details. Also available from stock:—

The famous Ronette Pick-up **at only** £7/9/1
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FOR HIGH FIDELITY—
YOU MUST USE A GOOD OUTPUT TRANSFORMER
BRAMCO

The new Bramco range includes a type to suit all applications. The following popular types are available from stock and when you consider that their frequency range is better than 20 to 15,000 cps, the price is very reasonable.

Special type for Jensen Twin Speakers 10,000 CT to 12.5 ohms.
10 Watt Ultra Linear type
10 Watt Mullard 5-10 type.

£5/15/- each

JABEL SWITCH

A miniature single bank switch. Ideal for tone controls, coils, switching, etc. The following arrangements are available.

2 pole 6 position
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3 pole 3 position
4 pole 3 position
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10/6 ea.

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We still have limited stocks of: —
Collaro 3/554 Record Player units 3 speed fitted with Ronette heads **£11/10/-**
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Philips 2002. Record Player. The ideal 3 speed unit for the portable .. .. ..

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A limited stock of Rola 12-0 Deluxe available. This is the best general purp speaker in this famous make, Fitted w large magnet and with 2 ohm voice c

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The following Efco dials are comp with escutcheon and lamp fittings are available with AWA or "H" calib tions.

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USL/32A. Cord drive. Straight line. Scale 6½in x 3½in .. ..
USL/37G. Cord drive. Straight line. Scale 5in x 1¾in .. ..
SLV/21. Cord drive. Vertical straight line. Scale 2½in x 3½in ..
USL/44. Cord drive. Straight line Scale 5in x 3½in .. ..
MSL/48. Straight line for Car radio. Scale 3 3/8in x 1 1/8in. ..
SLV/45. Cord drive. Vertical straight line. Scale 3½in x 5in .
USL/46. Cord drive. Straight line. Scale 9¼in x 4¾in .. ..
USL/51. As USL/46 but cream scale background .. ..
USL50. Cord drive. Straight line. Scale 8in x 8in .. ..

Replacement glass scales are availa for the above dials.

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Reduce that electrical noise
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R.C.S. 1¼in 6 pin Plug-in .. .. ..
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ELFO Standard 240V 60-watt with cord 4
Scope, 6 second Iron for 4 to 6-volt operation 5
Scope Transformer for using Scope Iron on 240V AC 47
Oryx. A real minature Iron for 6V operation, 12W 5

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STOP PRESS
JABEL PROBE

as featured by the Technical Editor in this issue—

Available from Stock

25/-

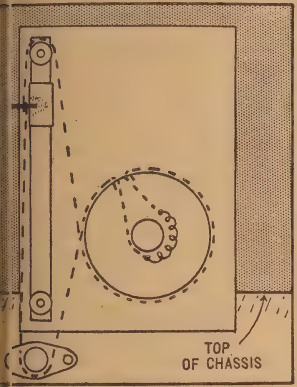
THE RADIO SPECIALIST

ce these problems have been ome and the major components ited on the chassis, the wiring be commenced.

e nature of the project prevents om giving exact details of the ıg, because what applies to one cular assortment of components not apply to another.

e usual precautions for avoiding bility should be observed, however. In particular the leads to the ator coil should be kept short. can be achieved by rotating the erter socket until the oscillator and grid pins face the oscillator and by using the front section e gang to tune the oscillator.

e converter control grid lead not cause any concern, as this ken directly to the grid cap of



iagram to help you restring the dial.

valve from the top of the gang.

e IF valve also has a top grid ection so that plate and grid of this valve are sufficiently rated. Depending on the type make of the IF transformers, a and grid cap may have to be d to the first IF transformer so it can be connected to the valve.

eight-lug tagstrip near the IF socket supports the oscillator screen dropping resistors, the HT AVC bypass capacitors, as well e AVC decoupling resistors and omponents around the detector. ded leads carry the detected signal from here to the volume rol on the front of the chassis.

further small tagstrip carries audio coupling capacitor and the resistor of the output valve.

small mica 100 pf capacitor ben the plate pin of the output by-passes any stray RF that have found its way into this s. Also from the plate pin a lead ken to the tone control on the of the chassis. This lead handles paratively high signal levels so it need not be shielded.

e filter capacitors and the back resistor are anchored to two tagstrips near the choke, which ounted on its side on the rear of the chassis. If, owing to transformer voltage, a dropping tor has to be used, this will have mounted on an additional tag, well away from the electrolyt-

e heater leads of the transformer erminated on the rectifier sockand heaters of the remaining es are fed from this point. One

(Continued on Page 115)

ULTRON 15T

AUDIO TAPE Head EXTRAORDINARY

At last—A head combining all the necessary features for wide range (20 c.p.s. to 20,000 c.p.s.) professional transcription at 15 ins. per sec., or maximum fidelity at the lower tape speeds, ULTRON 15T has both high and low impedance windings. may be used for recording and playback, and is available in half track or full track (ULTRON 15).

Developed specifically for optimum performance throughout the entire audio frequency range (20 c.p.s. to 20,000 c.p.s.). ULTRON 15T (Half track) features:—

★ TRIPLE MAGNETIC SHIELDING (—30 db. at 50 c.p.s.).
★ LINEAR RESPONSE TO 15,000 c.p.s. (—3 db. at 18,000 c.p.s.).
★ HIGH OUTPUT (half track, 30 mV average at 15in per second).
★ SELECTED FOR MINIMUM INTER-MODULATION DISTORTION.
★ MICRO-ALIGNED GAP (record and play with separate heads with no treble loss).
★ DIRECTLY INTERCHANGEABLE WITH TYPES HL2T and HE2T.
★ COMPLETELY FREE OF TREBLE RESONANCE (No load resistor required. Square wave tests show complete absence of "ringing").

Replace your present head with ULTRON 15T and you will:—
LOWER hum interference 10 to 30 db. RAISE treble stability 10 to 20 db.
RAISE treble response range up to 20 Kc.

FREE with every head:—Booklet containing complete Hi-Fi tape circuit, new equaliser, oscillator, head specifications, general information and advice to constructors.

Retail Prices:—ULTRON 15 and ULTRON 15T £9/13/9
HL2 and HL2T (Record-Play wide range) £8/18/-
HE2T (Record-Play standard commercial quality) £6/3/-
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(Note:—"T" denotes ½ track. All others full track.)

L.B. PRODUCTS TAPE HEADS are used by Government Departments and leading tape recorder manufacturers throughout Australia.

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MULLARD 5/10 AMPLIFIER

- Valves:—EF86, 12AX7 Push-Pull EL84s 5V4G.
- Power Transformer:—125mA giving plenty of reserve for tuner.
- Output Transformer:—Approved type to suit your speaker.
- Output:—12/13 watts.
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• PRICE:— £25/10/-
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3.5 Lens

A fraction of their original cost.

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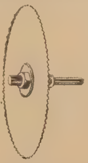

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English 0-50 Voltmeters, 2½in dial, AC-DC	42/-
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English 0-30 Ammeters, 2¼in dial, AC-DC	45/-
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BRAND NEW LEVER TYPE GREASE GUNS WORTH £4/19/6

47/6

Ideal for all types of Trucks, Tractors or Cars, 7500lb pressure.

LUCKY PURCHASE GENUINE R.A.F. RUBBER DINGHIES. BE EARLY. A FEW ONLY.

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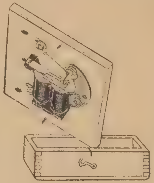

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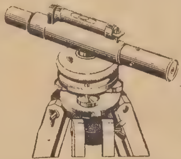

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£36/10/-

complete.

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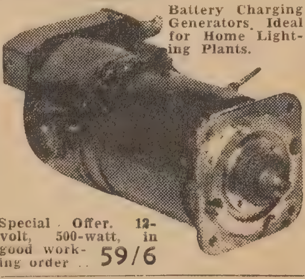
Brand New Fitted with English Selenium Rectifier.

Works off 230v. Household Supply.

Charges any battery, 6 volts at 4 amps, £6/15/- complete. Also available, 6 or 12 volt Charger combined. Charges 4 amps, £7/15/-. 6 volt, 3 amp Chargers, complete, £5/15/-.

Battery Charging Generators. Ideal for Home Lighting Plants.



Special Offer. 12-volt, 500-watt, in good working order .. 59/6

Not secondhand.

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Make yourself a Battery Charger

12v 2 amp	32/6
6v 5 amp	50/-
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Transformers to suit above Rectifiers. 2 amps, 39/6; 6 volt, 5 amps, 45/-; 12 volt, 5 amps, 55/-.

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Phone: FJ5904. Just 4 d

Mail Orders Carefully Pac
Please add Freight or Postage

Replace those broken side cur with cellulose acetate which the place of celluloid and lasts times longer. Will not dis

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Non-inflammable acetate she recommended for all types of curtains. Sheets are 20 thousa of 1 inch thick. Size of sheet, x 52in. Can be sewn or ceme into frames.

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Ideal for mechanics, radio re

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Complete in solid pig-skin leather case.

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At last the spotlight you been waiting for

Fitted with genuine American sealed beam globes. No motorist or boat owner should be without one.

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6 Volt, 90/-; 12 Volt, 95/ Complete with Switch and F

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6-volt, 37/6.
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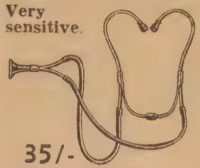
Include State in Address.

MECHANICS' STETHOSCOPES
Ideal for Testing Engines, etc.

Very sensitive.



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MK7 Goggles 37/6 Pair.
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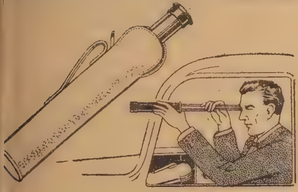

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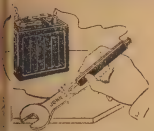
NEVER BEFORE AT THIS PRICE. EVERY MOTORIST should carry one. Ideal for Farmers, Naturalists, Shooters, etc. In Pigskin Leather Carrying Case. 20 Magnifications £5/5/-

AT LAST THAT ELECTRIC EGRAVER THAT WORKS OFF ANY 6 OR 12 VOLT CAR BATTERY



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Egrave your own tools, name p tes, dog collars, cutlery, watch c es, cigarette cases, etc. Engraved a icles are never stolen.
Aents wanted for Interstate and a country Towns. Write for details.

TEEL ARMY TANK AERIAL RODS WILL MAKE IDEAL RADIO AERIALS FOR CARS OR TRUCKS

T long for p tage. A vise u rest r way s tion. B es suit A ials.

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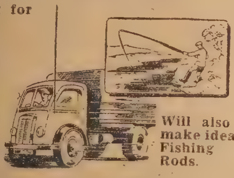

Will also make ideal Fishing Rods.

ft long, 3 sections. Each section 4, 22/6. 8ft long, 2 sections 15/-.

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Luminous Dial

£5/15/-

Makes ideal car clock

ted with Sweep Second Hand. Ideal for any car or truck.

Brand new American Wobble Pump, semi-rotary.

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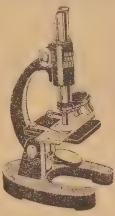
100-200 and 300 times magnification

Not a toy. A real Microscope. Hours of enjoyment for any boy or girl Student.



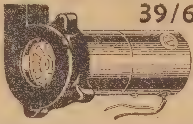
3 Turrets 3 Magnifications.

£4/19/6

Also available 4 Turrets 500 Mag. £8/10/-.

English Motor and Blower, 24 volts.

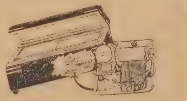
Will work off any Lighting Plant.



39/6

Large size also available that will work off 12 or 24 volts, £3/15/-.

Now you can make your own music box with these Swiss Music units. They can be fitted to any type of box, doll, jug, teddy bears, etc. Hours of enjoyment for all the family.



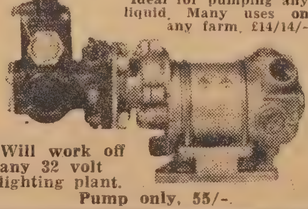
30/-

EACH

Tunes available: Lili Marlene, Blue Danube, Harry Lime Theme, Wedding March, Merry Widow, Happy Birthday, Annie Laurie, How Dry We Are, Roll Out The Barrel, Teddy Bears' Picnic. Also available, a few only, double units which play 2 tunes, 50/- each.
Miniature Music Units fit cigarette case, Lady's Compact, etc. 39/6, also 230 volt Music Unit, works continuously, 59/6.

AIRCRAFT 24 volts Motor complete with 400 gal. per hour Pump. Made in America.

Ideal for pumping any liquid. Many uses on any farm. £14/14/-



Will work off any 32 volt lighting plant.

Pump only, 55/-.

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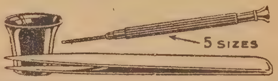

5 SIZES

English Tweezers	6/6 and 5/6
Eyeglasses	6/6 and 8/6
Extra strong double lens Eyeglasses	15/-
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BINOCULARS BINOCULARS
£5 Allowance on your Old Glasses.
Here is your opportunity to dispose of those old opera or out of date field glasses regardless of their condition as part payment on a modern pair of 7 x 50 or 10 x 50 high powered pair of binoculars as used by the broadcasters. These glasses are complete with a genuine pigskin case and are priced at the amazingly low figure of £23/15/- for 7 x 50 or £25/15/- for 10 x 50. There is no catch in this offer. These binoculars are brand new and are of the finest quality. Don't miss this opportunity. Remember the Olympic Games are to be held in less than 12 months' time. Just mail old glasses to us with your remittance for your £18/5/- or £20/15/- for the extra high powered 10 x 50, plus 8/- extra for reg. post.

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Genemotors, 12 volt input, 250 volt output 70 mills. 57/6
American Shrader tyre pumps, work from your spark plugs, 39/6. Car type fire extinguisher. Every car should cary one. Cost £7/10/-, £4/10/-. Brand new 7/8in spark plugs, suit most old type cars, 2/6, or ideal for tractors. S.A.E. or Whit. Spanner Sets, open one end, ringed the other. 6 spanners to set, 23/6. Army steel tow ropes, looped ends, 17/6. S.A.E. open end spanners, 6 to set, 24/6. Whitworth, 4 to set, 18/6. 4½in saw blades, complete with arbor, ideal for making saw bench with electric drill, 25/-. German Army marching compasses, work similar to prismatic, 32/6. Magnifying Glasses, 8 mags., 8/6. 10 magnifications, 12/6. 24 volt motor and hydraulic pump, capacity 3½ gals. per minute, £3/15/-. New headphones suitable for crystal sets, 17/6 pair. Tapped Transformers, 6, 12, 18 and 24 volts, 3 amps, 39/6.

R.A.F. BOMB HOISTS

33 to 1 ratio. Heavy construction. Ideal for adapting for garage work, lifting engines, etc. £10/15/-

Here's your answer, Tom!

Tom is back to his old form again. One of his questions could well provide the subject of a whodunit—"What's following what?" A "shocking" radio set plus some other assorted subjects make up the rest of this month's article. Let's have it, Tom!

What is a cathode follower used for? And just by the way —what follows the cathode in such a device?

Just a moment, Tom! Before we even start explaining, let us get this one thing clear. A cathode follower is not a special valve, in which something chases the cathode around and around within the glass envelope.

In point of fact, almost any valve (with the exception of the diode) can be used as a cathode follower.

The circuit of the cathode follower is extremely simple. The only difference from an ordinary amplifying stage is that the plate resistor is missing and the output is taken from the top of the cathode resistor.

This seemingly minor difference, however, accounts for a vastly different performance of the valve.

First of all, in the ordinary amplifier valve, the voltage at the plate becomes less positive when the grid voltage is made more positive and vice-versa. This happens because a more positive grid voltage causes a higher current to flow through the plate load, and as a result there is a larger voltage drop across it.

In other words the movement of grid and plate voltages is 180 degrees out of phase.

The voltage at the cathode, on the other hand, becomes more positive with a more positive grid voltage, because it depends upon the voltage drop across the cathode resistor. An increase in grid voltage will obviously cause a higher current flow and thus a higher cathode voltage. The voltage at the cathode always has a positive potential when caused by the voltage drop across a cathode resistor.

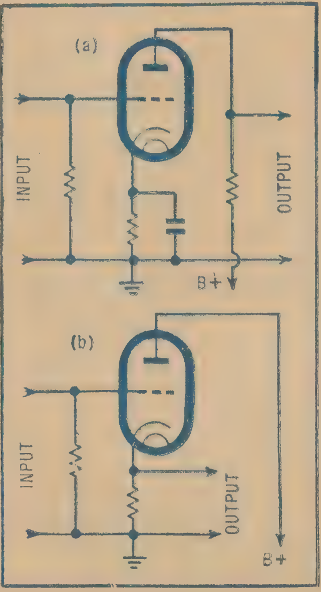
VOLTAGE PHASE

It can be said, therefore, that the cathode voltage is in phase with the grid voltage. This is how the arrangement derives its name—the cathode voltage "follows" that of the grid when potential changes are concerned.

In the ordinary amplifying valve voltage changes at the cathode due to changing audio voltages are prevented by a cathode bypass capacitor which is selected with such a high value that it is virtually an audio short circuit to ground.

This cannot be done in the cathode follower, because we could not expect to find any audio output from a point which is short-circuited in this way.

Now the cathode resistor is actually in both grid and plate circuits, since both these circuits are completed only when traced back to the cathode. And because these circuits are out of phase, we have a feedback effect in which all the output voltage is fed back to the grid, giving 100 pc feedback.



The essential difference between an RC coupled amplifier stage (a), and a cathode follower stage (b).

It's no use, therefore, to use a cathode follower as a voltage amplifier, because with 100 pc feedback it can never provide any gain at all. In actual fact it reduces the original input voltage by about one-tenth.

But the valve is useful in other ways.

For one thing, it has an extremely low output impedance. If you are handy at figures, Tom, its impedance is equal to 1/Gm in a 6J5; the output impedance, therefore, is about 3.8 ohms, irrespective of the value of the cathode resistor.

A second characteristic is th its input or grid circuit impe ance is extremely high, and, common with the low output i pedance, is the result of the hi degree of feedback associated w the circuit.

Thus, the valve makes an e tremely handy coupling device wh we have to couple a very hi impedance into a very low im dance and do not wish to use oth devices such as transformers.

In fact, the designer finds cathode follower very valuable. A so on to the next question.

My small reaction receive starts whistling as soon as the tone control is advanced beyond a certain point toward treble. While it was whistling, I accidently touched the "cold end" of the tone control and received a heavy shock. The meter showed about 250 v AC at this point Where does the whistling and the shock come from? Are they both caused by the same fault?

At first glance one would be i clined to say that the whistling m likely comes from the loudspeak Tom. As for the shock . . . well .

It seems highly probable, Tom, th the valves in your receiver are osc lating at an audio frequency. Th are not meant to behave this wa of course, but when they do, a when a power valve is included the circuit, these oscillations c become quite appreciable. We c say right now, however, that shock you will get from the au voltages produced by such osc lations is not likely to be lethal.

OSCILLATION DANGER

Small sets often have a hi gain output valve to provide au amplification and to operate a lo speaker. Such valves have a te dency to go into oscillation at au frequencies because of their h gain and the ease with which critical amount of output voltage m find its way back to the grid circ Such valves are often fitted with su pressor resistors to lessen this osc lation danger.

They may be quite stable wh operating conditions are normal, even a slight change in these c ditions, such as operating the action control, might be sufficien stimulate oscillation.

A little carelessness in the wir such as placing the plate and g leads close together, will prov the necessary feedback.

Why does the audio voltage ger

py the valve appear on the tone ol? Because tone controls in sets are usually placed in the it where high signal levels In the case of a two valve is often connected between the of the output valve and earth tween plate and screen.

CT OF CONTROL

h the tone control in the fully position the higher frequencies hort circuited to earth through ne control capacitor. As the un- ed oscillations usually occur at igher frequencies, they will thus ort circuited, and cannot reach oudspeaker.

t only are the oscillations pre- d from reaching the loudspeak- ut as they are short circuited, cannot reach the grid either. e being no feedback, the valve stop oscillating.

soon as the tone control is d toward the treble position, ever, resistance is placed in s with the capacitor, and only of the high frequencies is by- d. With the tone control wide anything up to 1 megohm may circuit and very little is by- d. Any high frequency signals hus reach the loudspeaker wir- nd from there the grid, starting scillations anew.

us, if you touch the cold end of one control capacitor — which ality is only "cold" for the DC voltage, but not for the AC l voltage — while the set is iating, the high voltage flows gh the low resistance of your , rather than through the 1 meg tiometer.

small capacitor connected be- n the plate and earth will pro- a permanent path for these er frequencies and avoid the bility of oscillation. In fact is a standard precaution taken almost any broadcast receiver.

If one uses a rectifier valve, h as a 5Y3, as a half wave tifier, would it be correct to one half of the valve only, should both plates be con- cted in parallel?

lf-wave rectifiers are not very used in receivers these days, , except perhaps in special , such as transformerless AC- receivers. Two half-wave rec- valves are often used, how- in transmitter power supplies ating in a full-wave circuit. this is only because it is easier ake two high power, half-wave fiers than one full-wave type. vertheless, it would be possible se say a 5Y3, or other full wave fier in a half-wave circuit, ld this be necessary. Whether use one half only or both es in parallel, will depend on voltage the rectifier is expected deliver, and at what current n.

the current drain is too high, rectifier will be unable to keep storage capacitor fully charged the voltage will drop.

point to consider is the peak ent rating of the one plate used. information can be extracted almost any valve handbook ng detailed operating conditions. is important, because if the e handles more than its rated rent, the maximum permissible dissipation will be exceeded and the valve may be permanently damaged.

Provided, however, that the half valve operates within its ratings, it could be safely used.

RECTIFIER IMPEDANCE

Vacuum rectifiers, such as mentioned earlier have a fairly high internal impedance, and considerable voltage drop occurs in them. The actual value varies with different types. If we were to operate the valve in a half wave circuit with both plates in parallel, the actual internal impedance would be only half that of the single plate, and the rectifier would be capable of delivering a higher output voltage.

So, even if the current drain does not require the use of both plates, the extra few volts HT might come in very handy, seeing that both plates are in a common envelope, and paralleling them would only mean a few seconds with the soldering iron.

An additional benefit would be that an accidental overload is less likely to damage the valve, if the plates are connected in parallel.

MEE-O-OW
Cahn

Is it possible to soundproof a house after it is built?

This is a strange question, Tom! By the look of things your next door neighbor had something to say about your enthusiasm for hi-fi amplifiers! Otherwise you may not be so concerned about soundproofing your home. Or is it because you are not so keen on hi-fi amplifiers?

Modern science has produced a lot of useful things, and not the least of them is effective soundproofing. It would be safe to say that the problem of soundproofing a house would not be unconquerable with modern techniques. Just how much it would cost is another matter.

Fully effective soundproofing involves coating the walls with some sound-absorbing substance, such as special wallboard, double plate glass windows, and special foundations to prevent vibration entering the rooms via the structure. Double sound absorbing doors are also necessary.

As such houses cannot be ventilated in the normal manner, forced ventilation, and possibly air conditioning, are frequently necessary.

Such elaborate soundproofing of complete buildings is generally confined to acoustical laboratories, or broadcasting studios.

(Continued on Page 113)

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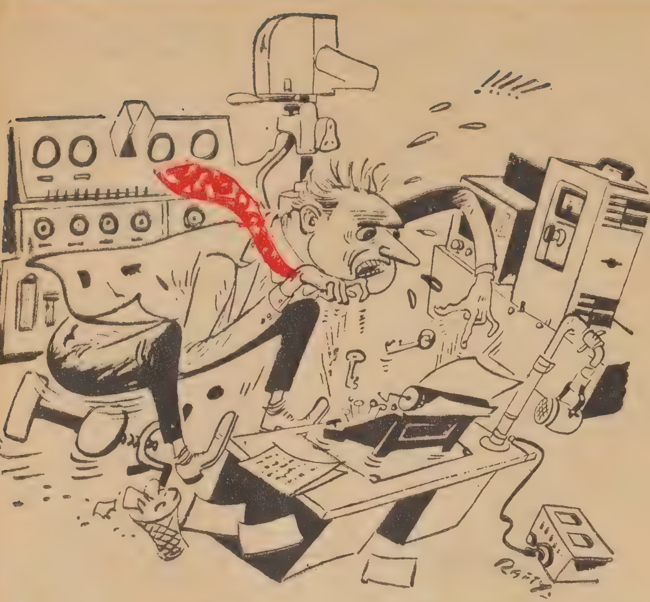

Let's Buy An Argument

Once again, I find myself penning these paragraphs long before readers have had a chanc to digest what was said in the last issue about electronic organs. Therefore there can be n opportunity here for retort, though this might be a welcome thought for those who are nc vitally interested in the subject.

by Neville Williams

IN the meantime, I have a further letter to hand from Mr. John E. Jung who, you may remember, started off this present discussion by some correspondence in the December issue.

While Mr. Jung's latest letter was written in more personal vein to Yours Truly, his remarks are nevertheless of sufficient interest to warrant publication on the opposite page.

No further comment is required.

CASUAL READING

The thing uppermost in mind at the moment is the number of times I have occasion to snigger or to snort at items encountered in everyday reading—a good deal of it enjoyed on the flat of my back at a south-coast fishing - swimming - sunburn resort.

With thoughts fresh in mind relative to organs, classic and otherwise, I read with interest the remarks of one, Edward Tatnall Canby, music critic for our contemporary mag Audio.

After reviewing, in suitably learned fashion, a whole series of very "propah" organ records currently available in the US, he gets around to mentioning an exhibitionist piece done on the "Mighty Wurlitzer Pipe Organ". This is what he has to say:

"And here it is! The gorgeous, fat, multi-colored theatre organ, 256 stops including a real brass trumpet and a sax. section and a real piano (played, we can suppose by remote control), plus the usual belly-jingling vibrato the harps and chimes and steam calliopes . . . phew!

"Such sounds as you can hardly believe (unless you're an old-time movie-goer) whole orchestras of "real" brass, crashing chimes that make you jump, pulsing melodies, a new stop and a new sound e second.

"Arrangements in the mc (i.e. radio manner) of every from "Pal Joey" and "You M Kick It Around" and each and one is a gem of theatre orga the pure and windy power stuff is fast vanishing today before pale onslaught of electronics. H Absolutely terrific!

"Quite honestly, apart from very special Biggs Toccata in Minor, fourteen fold, the only records in the above batch th REALLY enjoyed (and would acquired for my own) are these two, poles apart. On the one Pachelbel & Co. from 18th cer Germany and on the other Mighty Wurlitzer.

"It's a funny world."

TELEVISION ENGINEERS

Yes, Mr. Canby, it's a funny w and we all help to make it so.

Then there was the little c from, I think, Reader's Digest suggested that:

"Television is the place where little pictures go" . . . or word that effect.

Then from the Enginee Faculty Handbook, NSW Unive of Technology, I must pass on t two definitions. One defines Chemical Engineer:

A CHEMICAL ENGINEER . is a person who can exp chemistry to engineers and engin ing to chemists, but who can't plain engineering to engineers chemistry to chemists!.

IS THIS YOU?

Alternatively, if you fancy y self as a radio engineer, this de tion from the same source m possibly apply:

A RADIO ENGINEER . . . person who passes as an exac expert on the basis of being abl turn out with prolific fortitude finite series of incomprehens formulae calculated with mi metric precision from vc assumptions based on debat figures taken from inconclusive periments carried out with ins ments of problematical accuracy persons of dubious reliability questionable mentality for avowed purpose of annoying confounding a hopelessly chimer group of esoteric fanatics usu

red to all too frequently as
CTICAL RADIO MEN.
ose were the “sniggers” I re-
d to. The “snorts” were all
cts from the daily or the local
regarding matters of radio
est.

rhaps a few howlers are in-
ble when technical matters
to be explained to the man
e street; when a person, know-
g the facts, who can't express
elf, explains things to another
on who can express himself
out knowing the facts so that
n turn, can enlighten people who
't very interested in either
or expression!

that as it may, I came across
article which emphasised the
riority of FM broadcasting by
ng that it had no secondary
ice area, then summing up by
ning that “FM gives three times
reception of AM”.

hile claiming some small con-
ion with the technical side of
, I must confess that this lat-
statement is completely beyond
comprehension. Just what does
ee times the reception” mean?
es it mean that each station
serve three times as many lis-
rs, that the signals are tonally
e times better or that they are
e times more proof against in-
ering noise?

don't know, do you?

ONDARY SERVICE

is quite true that AM broad-
stations, as we know them,
e a secondary service area—an
beyond say 50 miles from the
ion where the signals are audible
often weak and subject to fad-

his hasn't been an entirely bad
g, of course, because, from the
inception of broadcasting, it
ensured some kind of a service
listeners in remote areas. Most
ions have, at some time or other,
ived listener reports from all
es of the Commonwealth and
from overseas.

ut herein also lies the “rub”.
ause the signals do stray over
distances, they produce mutual
rference between stations per-
s thousands of miles apart. As
esult, it has become well nigh
ossible to provide channels for
broadcast stations wishing to
e specific local areas.

M stations are more accommo-
ng in this respect because, being
the VHF band, they do not have
secondary service area in the
e sense as an AM broadcast
ion.

ut this doesn't mean that FM
adcasting eliminates the prob-
s of weak signals and fading—
like that; or that an FM trans-
ter would magically provide all
present listeners to an existing
adcast station with a strong,
sefree signal.

ar from it.

he primary service area of an
transmitter is certainly no
ater than that of a conventional
adcast station, though its con-
ration may be different. Be-
d this primary service area lis-
ers don't get weak signals or
ing signals; they don't get any-
ng!

BIG DEMAND FOR PIPE ORGANS

Dear Sir,

I must first of all thank you for publishing my letter re the electronic organ in the December issue, and for the very fair and informative comments which accompanied same; I sincerely hope they will promote further discussion on this most interesting subject.

There are one or two points I would like to make relative to your commentary under the heading “Let's Buy an Argument”. I heartily agree with all you have said; I, like you, am fond of crawling all over a big pipe organ — in fact I had two most enjoyable hours recently, spent whilst climbing all over the organ in the City Hall at Brisbane.

I am also very partial to the cinema organ and its music and feel that these unified and duplexed instruments as developed by the late Robert Hope-Jones have done more to bring organ music to the public than all the straight instruments which are worshipped by the “Purists”.

Finally I am very keen on the electronic organ, and my most earnest desire is to foster the development of these instruments, which no doubt stems from a keen lifetime interest in radio (I held an experimental licence as far back as 1921).

I am afraid you are wide of the mark in assuming that the production of pipe organs is past its peak. For many years I have been a subscriber to the leading organ journals in Britain and USA and I can assure you that there are more of these instruments being built in these countries today than ever before.

There are more organisations engaged in this business than ever before and all are booked out with orders for several years ahead. The same applies to the few people building pipe organs in Australia.

Nevertheless it is also a fact that the production of electronic organs is racing ahead in an amazing manner.

Now regarding your description of the Allen Organ, had you not mentioned that it was an Allen, I would have been in a quandary as to whether it would be an “Allen” or a “Haygren”, as the specification would fit either.

There is a very close similarity between these two instruments, and it has always been a source of wonder how either one or the other is not infringing the patent protection of the other party.

In any case the instrument which you described is only one of the smaller models.

You may be interested to know that I have a recording sent to me by the Allen Company — on one side is a series of tonal demonstrations of the various pipe and percussion voices, and on the other side is part of the toccata from Widor's Fifth Symphony.

This recording was recently played at a meeting of the Sydney Organ Society, of which I am a member, and there was not one of those present who guessed it was not a pipe organ recording and, incidentally, I feel that it did a lot to break through the barrier of prejudice by a lot of the “Purists” who belong to the Society.

No, Mr. Williams, I am not a Purist but I feel that if an electronic organ is to replace the pipe organ, then the more it resembles it in such details as envelope control and ensemble effect, the sooner it will be accepted in its rightful place.

Yours faithfully,

John E. Jung.

If an FM broadcasting system is to give a better service to more listeners, it won't be because of greater coverage from individual stations. It will only be because channel-sharing in the VHF region will allow lots more “local” stations to operate.

NOISE, FIDELITY

As for noise-rejection qualities and ultimate fidelity, the end result will depend more on the design and use of receivers than the possibilities of the FM system.

Currently-produced AM receivers are built down to a price, “installed” with a minimum of forethought and often tuned by the user in a very slipshod fashion. If this same approach is adopted for FM receivers, I'm afraid that the man in the street will be sadly disillusioned by the sounds which might issue therefrom.

Another article I read on the same general subject foresaw no special difficulties from the receiver angle. I quote:

“Experts say existing amplitude modulation (AM) receivers can easily be modified to receive FM broadcasts.”

Not just one expert, mind you, but numbers of them. Why have they hidden their lights for so long beneath their respective bushels?

The late Major Armstrong would have given his back teeth to meet these experts and learn about this easy modification.

We'd like to hear from them, too! We'd be only too happy to pay for the publication of a “How To Do It” article.

The contributor's proper name would have to be used, however. We couldn't possibly undertake to publish a technical feature credited to “Father Christmas”.

TIMBER HOUSES

Last, but not least, I must mention yet another article which advised me to build a timber home because I would thereby be assured of better TV reception!

You know, I'd never thought of that before. But why stop at wooden walls? Maybe a shingle roof would give a 3D effect to the picture, while wood-block paths around the gar-

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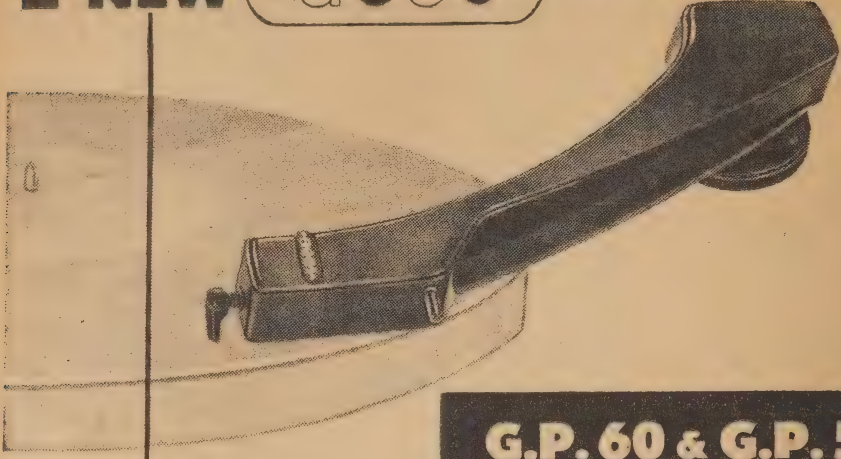

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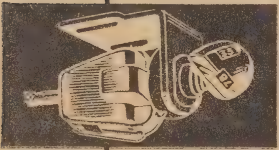

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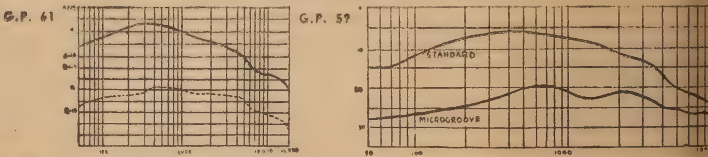

Response Curves of G.P. 61 (left) and G.P. 59 (right) turnover pick-ups fed into a 1 megohm loa

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de might allow it to be received in CinemaScope and full color!

ut perhaps I'm being cynical. Tut, tut!

only know that, if one erects a V aerial in an advantageous position and feeds the signal down a proper transmission line to the set, it oesn't matter whether it's housed in a showplace or a shanty, a wigw n, a tepee or a gunyah.

s Phil Watson said when he read these lines ("You're still gunyah get your picture anyway!")

Of course, the signals picked up by indoor aerials will be affected by environment but I'd be surprised if the walls had anything like as much to do with the field strength as the roof, the plumbing and the electrical wiring.

Wooden it?

SPEAKER NETWORKS

Since publishing our recent article on multiple loudspeakers, we have had a steady stream of inquiries from readers who want to know whether it is possible to use a loudspeaker dividing network in the voice coil circuit of an amplifier as well as one of the top-cut filters we described some years ago.

This is a question which cannot be answered with a simple yes or no. To make it even harder, the answer may not even be the same in every case.

But before trying to answer the " it possible" part of the question, it may be as well to conduct a little quiz among ourselves.

QUESTION: Why does one use two speakers and a frequency dividing network?

ANSWER: In an attempt to achieve wider frequency response and lower intermodulation distortion.

RETORT: Correct, but remember that properly designed, complementary speakers must be used to achieve these desirable results.

COMMENT: No matter how good the speaker system, its potential can only be realised when fed with a signal containing a minimum of distortion.

QUESTION NUMBER 2: Why does one use a voice coil top-cut filter?

ANSWER: To prevent distortion components from being unduly emphasised, when distorted program material is being reproduced through a wide-range loudspeaker system.

RETORT: Correct, it being assumed that one occasionally may want to listen to a record or program, even though distortion is known to be present on it.

COMMENT: The presence of the original distortion and the use of a filter means quite automatically that the result cannot be "high fidelity".

OPPOSITE FUNCTIONS

Plainly enough, the two devices are contradictory in their function and it isn't really logical to use them gether.

Where multiple speakers are used, e better course is to provide switching so that the high frequency eakers can be removed from circuit, thereby limiting the treble response.

WHY NOT MORE TREBLE BOOST?

Dear Sirs,

I set out a theory which you may see fit to include in your "Let's Buy an Argument" series.

In your article on "An 8 Valve Radiogram" on page 64 of the September issue you state the following:

"Treble Boost may be used to offset to some extent the loss of top response due to side band cutting in the tuner, thus giving some semblance of wide-range reproduction."

Why not go further and say "To offset all the top response due to side band cutting?"

I have adopted similar methods in all sets I have built having selective tuners, and have found the results entirely satisfactory.

You will probably reply saying that you cannot restore what just isn't there, but it sounds all right and that is what counts in the average listener's vocabulary.

I often use a small degree of treble boost across the volume control, and at all but maximum setting this works wonders.

I enjoy your magazine more than any other radio periodical I have seen, and look forward to receiving each issue.—L. R. M., Auckland, NZ.

If the tweeter speaker is fed via a coupling capacitor and operates above about 5Kc, opening one lead to the tweeter will remove it from circuit and limit the response to that of the bass-and-middle speaker alone.

If a full-scale network is used, crossing over at about 1Kc, it should be possible to switch it out of circuit completely and divert ~~all~~ the output to the bass speaker, again limiting the treble response.

LEVEL CONTROLS

Some of the more elaborate speaker networks provide level controls on the middle and tweeter speakers and manipulation of these will tailor the response to any desired overall pattern.

By thus removing speakers from circuit, partially or completely, the treble response can be reduced and, at the same time, complexity avoided in the voice coil circuit.

And here we can begin to answer the "is it possible" part of the original question. We can say that, as a general rule, it is a good thing to avoid complexity in the voice coil circuit. This is so for two reasons:

(1) A multiplicity of chokes and capacitors in the voice coil circuit can promote permanent or peak-level instability in some amplifiers, particularly those using a high degree of feedback around the output transformer.

(2) Spurious and unforeseen resonance effects can occur when two sets of resonant components feed directly into one another. If the voice coil is considered also as a complex LCR circuit, an additional source of complication must be admitted.

MAY NOT HAPPEN

Of course, there is no guarantee that an amplifier will oscillate under these conditions or that troublesome resonance effects will occur. There is therefore no special objection to trying out the amplifier feeding into a top-cut filter and thence into a dividing network. If it works, well and good!

However, it would be good practice to see that the filter is removed from circuit or shorted out in the "open" position, to avoid any risk of compromising results.

It would be better practice still to discard the filter and achieve the necessary control over response by diverting the output to or from the higher frequency speaker (s).

It is something you simply can't do, when using a single wide-range speaker. Hence the filters.

Just in passing, I notice that an American firm marketing a multiple speaker kit has turned a necessity into a virtue. Instead of providing level controls on individual speakers, which can be present and then forgotten, the controls are made a feature—and how!

LOVELY NAMES!

One of them—I judge to be the "middle" speaker control—is marked "Presence". The other, doubtless controlling the tweeter, is marked "Brilliance".

That's modest enough, but the name of the gadget really slew me . . . The "Acoustic Baton".

I quote:

" . . . *By adjusting the speaker system for proper balance to suit the acoustic requirements of your room, you recapture the full beauty of the original performance.*

"In a way, you are acting as a conductor."

Acoustic Baton ! " / &_' ( ) £

(You get the above effect by running along the top keys of a typewriter.)

A New Zealand reader raises another question which has been put to us many times. As you can see for yourself, he wants to know why we don't exploit more fully the idea of using treble boost to offset the sideband losses in a conventional receiver.

It would seem to be a very easy way of achieving wide-range reproduction from a very ordinary kind of radio tuner.

I only wish it were as easy as that!

The suggestion by L.R.M. cannot be condemned altogether on the grounds "that you cannot restore what just isn't there". The average radio tuner doesn't simply lop off all frequencies above a certain figure; rather does the response taper off, the output becoming less as the modulating frequency gets higher.

One can always count on restoring something by treble boosting in

(Continued on Page 115)

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6Y6	17/6	RK48A	£3
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PHONE LA 3845

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1.879 1.EB34 1.5BP1

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3 Valves, 0-1 M. A. Meter
Slow-motion dial

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convert to 144 M.C.S.

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Input	Output		
24V	250V	100MA	£1 0 0
24V	550V	375MA	2 0 0
24V	250V	60 MA	1 5 0
12V	270V	100MA	3 15 0
12V	500V	350MA	8 10 0
12V	1200V	200MA	6 10 0
6V	500V	150MA	6 10 0

Amplification
Communication
Electronics

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PHONE
LA 3845

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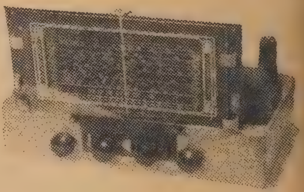

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RADIOGRAM CHASSIS
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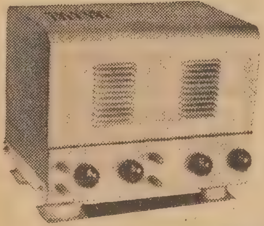

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136 VICTORIA R'D. MARRICKVILLE, SYDNEY, N.S.W

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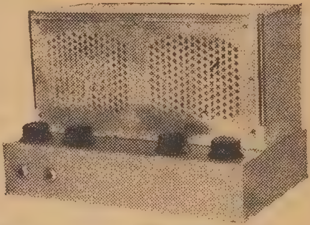
DULWICH HILL, UNDERCLIFFE, EARLWOOD TRAM AT DOOR. STOP No. 42.

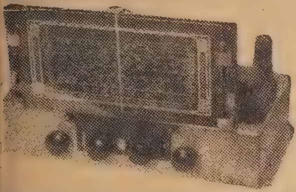
HI-POWER P.A. AMPLIFIER 50 WATTS



B Class 807PP cathode follower drive Ferguson OP Transformer for line or voice coil matching. Complete with valves. Operates from 240AC or 6v.DC from separate power supply.

£21

Power supply AC 240v. £12/10/- 6v. DC £9/10/-



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5-VALVE DUAL WAVE
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COMPLETE STATION INCLUDING ALL ACCESSORIES & POWER SUPPLY

Operates from
12 VOLT DC

£75

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SUITABLE YACHTS, SMALL SHIPS AND TRAWLERS.

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NEW SCOTCH BOY

1200ft spools—limited quantity

AT **£1/17/6** Postage 1/6

USED EMITAPE Ex LEADING BROADCAST STATION

First Class Condition.

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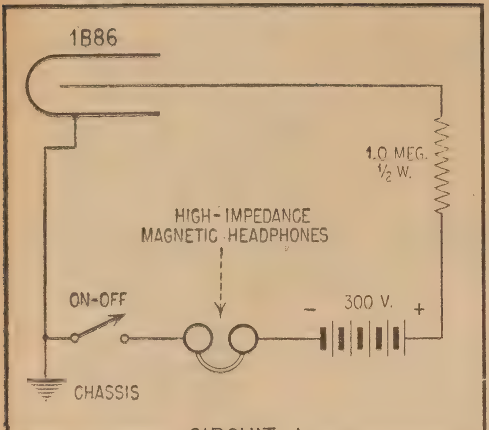
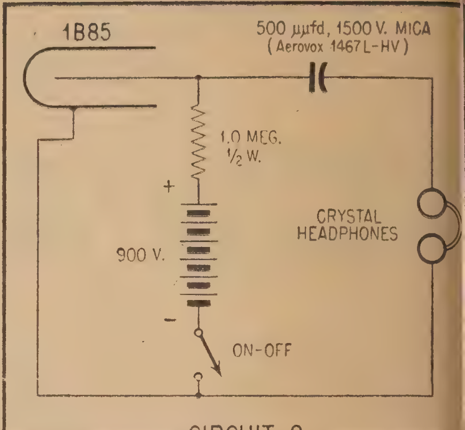
CIRCUITS FOR GEIGER COUNTERS


1B86
1.0 MEG.
½ W.
HIGH-IMPEDANCE
MAGNETIC HEADPHONES
ON-OFF
300 V.
-
+
CHASSIS

CIRCUIT 1


1B85
500 µµfd, 1500 V. MICA
(Aerovox 1467L-HV)
1.0 MEG.
½ W.
+
900 V.
-
CRYSTAL
HEADPHONES
ON-OFF

CIRCUIT 2

Although the subject of Geiger counters was discussed at length in these columns a couple of years back, plenty of questions are still put to us regarding their design. This article by Aerovox Engineers should prove valuable as a further general review of the whole subject.

LIGHTWEIGHT, portable radioactivity detecting instruments at present are in demand both for prospecting and for civil defence stocks.

Although small Geiger counters are available commercially in a variety of types and over a wide price range, many electronic technicians and engineers will elect to build their own.

The technician has a number of circuits from which to choose. The beginner undoubtedly will select the simpler ones.

A simpler instrument also will be the logical choice for the person having no interest in uranium prospecting, but wanting to keep a Geiger counter handy for probable civilian emergency use.

In such an emergency, such as might follow a bombing, the rad activity level would be expected be high, and the high sensitiv of more complicated instrume not needed.

The more serious uranium pr pector would seek the higher s sitivity of the more complex c cuits.

In any event, the technician w builds his own Geiger counter e pects that, in addition to the ed cation and enjoyment secured fr the work, his insrument will c him less than a comparable mar factured one.

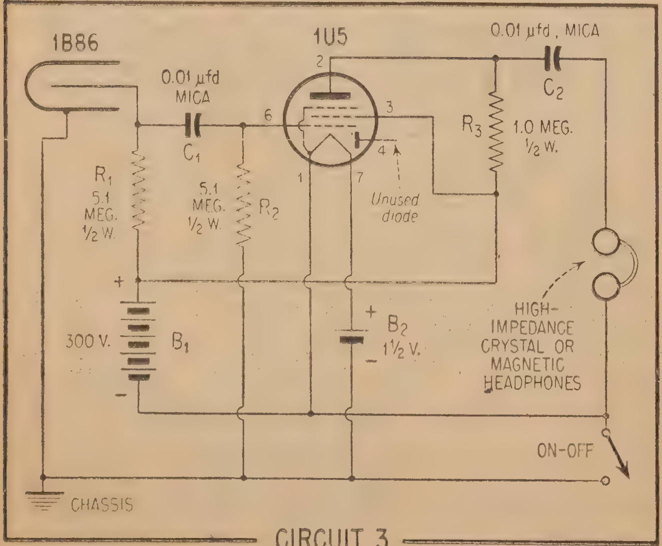
In this article we have gathe together a representative group simple Geiger counter circuits. Th circuits have been tested. All fr have been eliminated in order obtain foolproof ope"ation and ensure that any reasonably co petent technician might duplicate instruments successfully with dinary tools and equipment.

The counter tubes used in the c cuits shown here are Victore types 1B85 and 1B86. Tubes hav equivalent electrical characterist also may be employed.

The 1B85 requires a DC operat voltage of 900V. Its threshold v tage is 800V. and its minim plateau length 200 volts (plate slope 3 pc/100V). Its life is million counts.

(Editor's Note: While these Ame can-type tubes may not be direc available on the local market. circuits and methods discussed wo apply equally well to other type tu having comparable voltage rating

The counter tube may be opera in a probe on the end of a shiel cable, or it may be installed ins the instrument case, with a suita opening, holes, or louvres for en of radiant energy.


1B86
1U5
0.01 µfd
MICA
C1
R1
5.1
MEG.
½ W.
5.1
MEG.
½ W.
R2
2
3
6
4
1
7
Unused
diode
0.01 µfd, MICA
C2
R3
1.0 MEG.
½ W.
+
300 V.
B1
-
+
B2
1½ V.
-
HIGH-
IMPEDANCE
CRYSTAL OR
MAGNETIC
HEADPHONES
ON-OFF
CHASSIS

CIRCUIT 3

ally, the differences between counter circuitry result from method of obtaining the high for the counter tube, (2) amplification is employed, 3) whether indications are visual or both.

representative Geiger coun- cuits are shown. These are ed separately in the following aphs:

CUIT 1.—This is the simplest e arrangement. Here, a 1B86 tube is connected in series miniature 300-volt battery r to Burgess U200 or RCA , headphones, and a 1- n current - limiting resistor. T switch allows the circuit disabled when not in use. or's note: The above bat- are equivalent to the locally- type 493, which is available r.)

OF CURRENT

ionizing particle penetrat- counter tube causes a pulse ent to flow through the cir- nd this produces a click in adphones.

rder to complete the circuit dphones must be of the mag- ype, and must have high im- e. A stepdown matching rmer would be required for pedance headphones.

al-type headphones, although ing remarkably high imped- e unsatisfactory in this cir- cause they provide no con- t for DC

1B86 is a glass-wall gamma be. Its diameter is 0.4 inch, overall length, including its tinned leads, is 4¾ inch.

more compact assembly or -sized probes, Type 1B88 tube may be substituted. The lso has a diameter of 0.4 inch, overall length (including nned leads) is only 2¾ inches. 300-volt Type U200 battery es 2 11-16in x 2 7-32in x 3 .

CUIT 2.—The sensitivity of the battery-operated counter may roved by employing a general- betagamma counter tube, Type 1B85, with a 900-volt pply.

GE SUPPLY

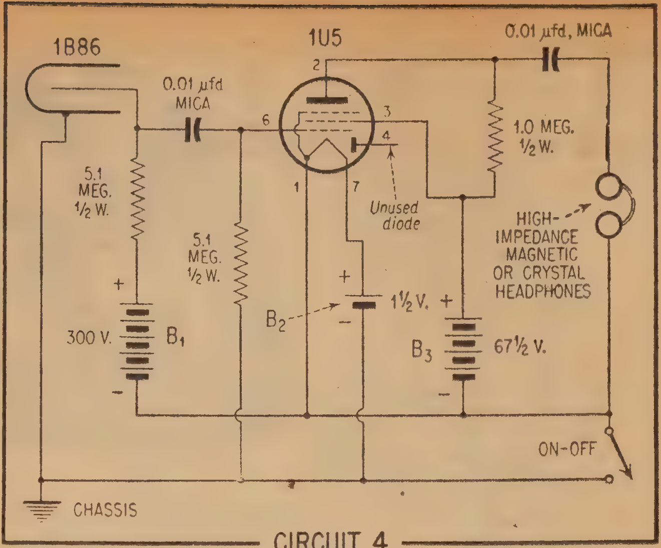
high voltage is obtained from niniature 300-volt batteries as specified for single use in 1) connected in series. Cir- shows this arrangement.

cuse the 900-volt potential con- a serious shock hazard, we recommend connecting the ones in series with the other ts in the way this was done in 1.

ad, high-impedance head- are capacitance-coupled to uit through a 500 pF. 1500-volt apacitor. Crystal-type head- can be used to advantage in cuit.

1B85 is an aluminium wall aving an A1-82 coaxial base. meter is 51-64inch, and its length, including the coaxial s 4¼ inches.

use of the higher DC voltage ed in Circuit 2, particular care e exercised during construction nstrument to insulate the vari- rts of the assembly. To pre- eakage, use only high-grade groscopic insulating materials.



CIRCUIT 4

and keep all circuit points separated as widely as possible.

CIRCUIT 3.—In this arrangement, a pentode amplifier has been added to the rudimentary circuit (Circuit 1) to increase sensitivity and to provide louder clicks. Pulses from the 1B85 counter tube are transmitted to the grid of the 1U5 amplifier through coupling capacitor C1.

The midget 300-volt battery, B1, supplies both the counter tube and the plate and screen of the amplifier. The second battery, B2, is a 1½-volt size D flashlight cell. The SPST ON-OFF switch is connected to open both battery circuits simultaneously when in its OFF position.

Maximum efficiency will be obtained with high-impedance headphones. Crystal-type phones are recommended.

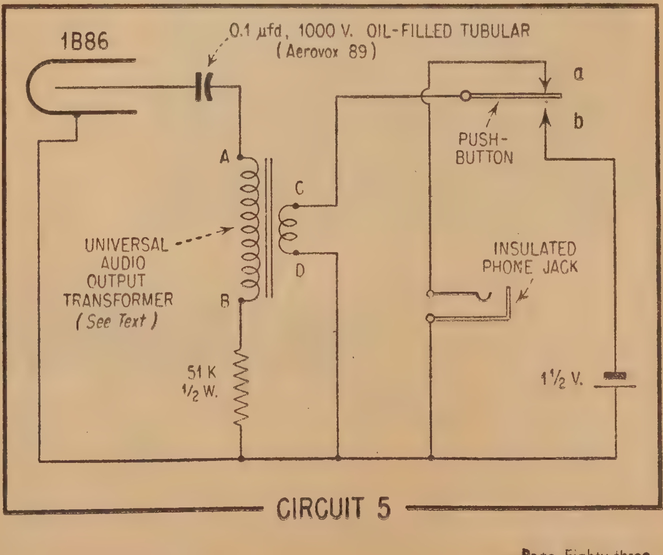
The shorter Type 1B88 counter tube also may be employed in this circuit.

CIRCUIT 4.—This is a variation of Circuit 3. Here, the plate and screen of the 1U5 tube have been disconnected from the important 300-volt battery and are supplied by the separate, midget 67½-volt battery, B3. In all other respects, Circuit 4 is identical to Cricuit 3.

This circuit change is important when the instrument is to be used regularly over protracted periods.

Under such circumstances, removal of the tube drain from the 300-volt battery and the consequent longer life of this battery sufficiently offsets the additional cost, complication, and weight of the additional battery, B3, to warrant the modification.

The SPST switch interrupts all


1B86
0.1 µfd, 1000 V. OIL-FILLED TUBULAR
(Aerovox 89)
a
b
PUSH-BUTTON
A
C
D
B
UNIVERSAL AUDIO OUTPUT TRANSFORMER (See Text)
INSULATED PHONE JACK
51 K ½ W.
1½ V.

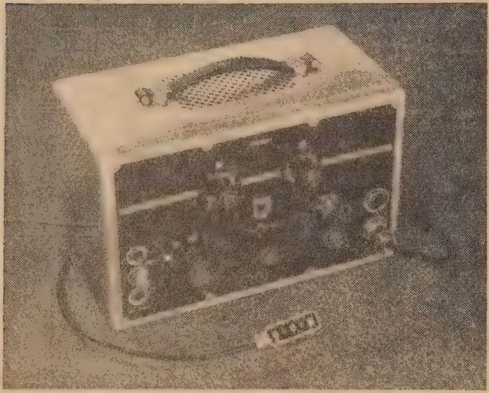
CIRCUIT 5

PHILIPS TV TESTING EQUIPMENT

DESIGNED FOR THE TV SERVICEMAN

GM2891 TV SERVICE PATTERN GENERATOR 40 TO 225 Mc/s

CC1R with 5.5 Mc/s Separation

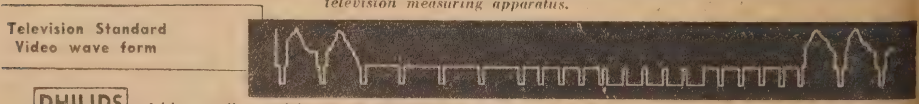


The Philips TV service pattern generator 40 to 225 Mc/s is designed for testing the overall performance of the TV receiver during those periods when regular transmissions are unavailable or unsuitable.

The Philips TV service pattern generator enables the following checks to be made:

- **Vertical and horizontal linearity**
- **Synchronisation**
- **Transient response**
- **Audio channel**
- **Sound to vision distance**
- **Sensitivity**

This unit is but one of Philips comprehensive range of radio and television measuring apparatus.



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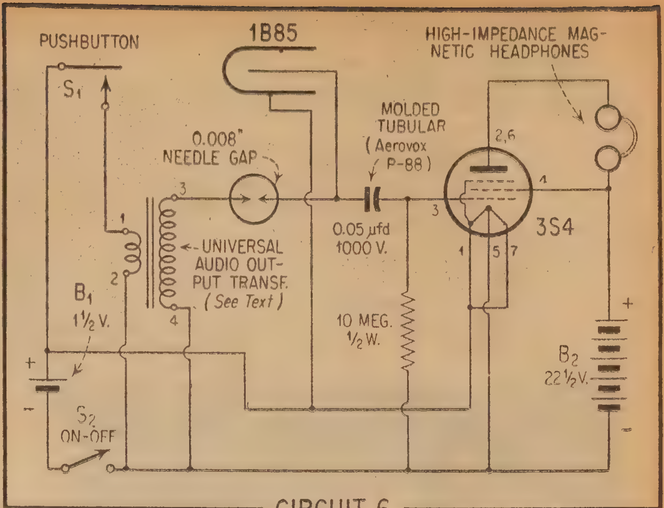
148 Edward Street, BRISBANE • 381 Murray Street, PERTH
119 Grenfell Street, ADELAIDE

PG36-55


PUSHBUTTON
S1
1B85
HIGH-IMPEDANCE MAGNETIC HEADPHONES
MOLDED TUBULAR (Aerovox P-88)
0.008" NEEDLE GAP
1
2
3
4
B1
1½ V.
UNIVERSAL AUDIO OUTPUT TRANSF. (See Text)
0.05 µfd 1000 V.
10 MEG. ½ W.
2,6
3
4
1
5
7
3S4
+
B2
22½ V.
-
S2
ON-OFF

CIRCUIT 6

ree battery circuits when thrown to OFF position.

CIRCUIT 5.—This is an interesting 0-volt geiger counter which is wered from a single 1½-volt size D shlight cell. The high DC voltage quired for operation of the 1B86 unter tube is obtained by charging capacitor through a high-turns-tio stepup transformer.

The transformer may be any small iversal replacement-type output it. Terminals A and B represent e ENTIRE primary winding of this ansformer. (Do not use the centre p.) Terminals C and D are two of e low-impedance connector lugs lected from the transformer connec-n chart for a turns-ratio between) and AB of 300 to 1, or higher.

The SPDT pushbutton switch nor-lly rests in position "a". This nnects the headphones (plugged o the insulated phone jack) to the v-impedance winding of the trans-rmer.

HARGE TIME

When the switch is depressed and leased momentarily, making a ick make-and-break connection in sition "b", a high-voltage pulse is induced across the high-turns wind-g, AB. This pulse fires the 1B86 be and charges the 0.1-microfarad pacitor.

Several repeated operations of the shbutton switch will charge this pacitor fully.

With the switch resting in position ", the capacitor cannot discharge rough the circuit because of the in-lating property of the 1B86 when is not fired. The capacitor accord-gly retains its charge and serves as 900-volt source.

When the counter tube is penetrat-by a radioactive ionising particle, wever, it fires and induces a volt-e across winding CD, and this pro-ces a click in the headphones.

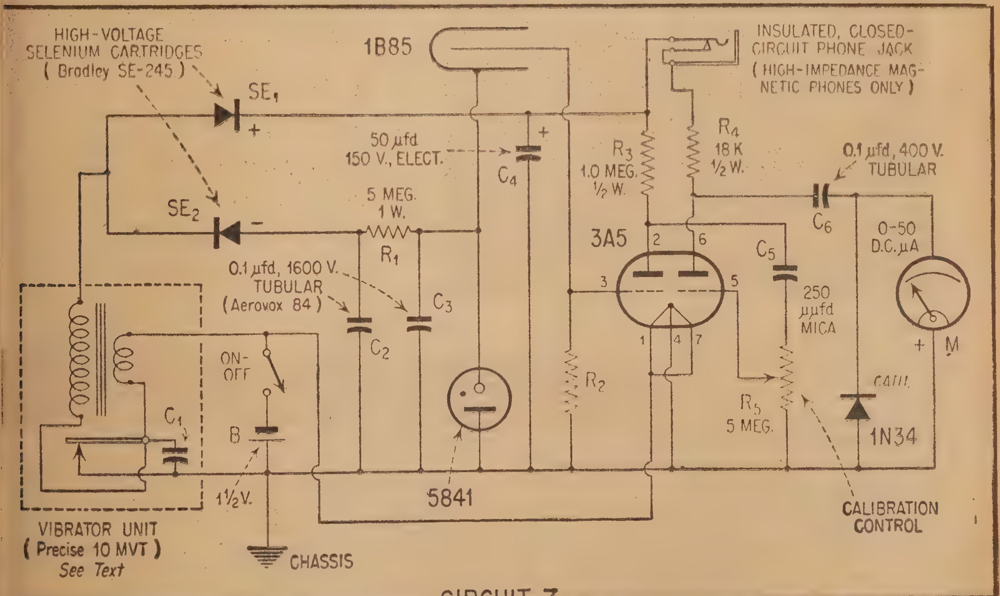
The length of time the capacitor ll hold its charge depends upon the kage characteristics of the capacitor and how well the circuit is protected from ambient humidity. This will vary from 5 to 30 minutes in most cases. As the charge leaks away, because of either leakage or rapid counting, the capacitor may be recharged readily by quickly pulsing the pushbutton switch several times.

Because of the nature of this circuit, very small size may be attained in the completed instrument. An added advantage is the fact that the headphones, being inductively coupled, are not included directly in the high-voltage circuit and any possibility of shock, ground, or short circuit consequently is removed.

CIRCUIT 6.—The high potential of 900-volts is obtained in this circuit also by pushbutton-pulsing a 1½-volt cell through a backward-connected universal output transformer to charge a capacitor. Here, however, terminals 1 and 2 of the transformer are the lugs (selected from the transformer connections chart) which supply the LOWEST impedance.

This permits the highest stepup ratio. Terminals 3 and 4 represent the ENTIRE primary winding of the transformer. (Do not use the centre tap).

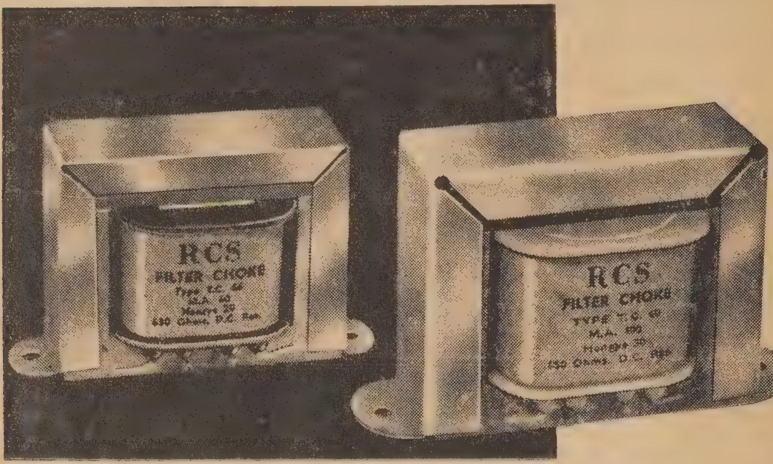
A small needle-type spark-gap is connected between the 1B85 tube and the high-voltage winding of the transformer. A discharge takes place across this gap when the pushbutton (S1) is depressed and released, and the capacitor is charged. Several successive, rapid pulsings of the pushbutton will charge the capacitor fully


HIGH-VOLTAGE SELENIUM CARTRIDGES (Bradley SE-245)
SE1
+
SE2
-
1B85
50 µfd 150 V., ELECT.
C4
+
5 MEG. 1 W.
R1
0.1 µfd, 1600 V. TUBULAR (Aerovox 84)
C2
C3
ON-OFF
C1
B
1½V.
5841
VIBRATOR UNIT (Precise 10 MVT) See Text
CHASSIS
INSULATED, CLOSED-CIRCUIT PHONE JACK (HIGH-IMPEDANCE MAGNETIC PHONES ONLY)
R3
1.0 MEG. ½ W.
R4
18 K ½ W.
0.1 µfd, 400 V. TUBULAR
C6
3A5
2
6
3
5
1
4
7
C5
250 µµfd MICA
R2
R5
5 MEG.
0-50 D.C. µA
+
M
CATH.
1N34
CALIBRATION CONTROL

CIRCUIT 7

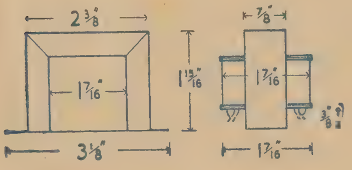
R.C.S. release details of . . . CHOKES . . . TRANSFORMERS

Here are full details of types available in R.C.S. filter chokes, audio chokes and transformers, filament and auto transformers, speaker transformers and speaker replacement windings. It is suggested that these details be kept for reference. These R.C.S. components are both designed and manufactured in the light of latest findings in the field of electronics. Brackets are of aluminium and bobbins are of moulded polystyrene.



FILTER CHOKES AND SPEAKER TRANSFORMERS

Size: Core Section ¾in x ¾in 10 watts
o/all sizes 2⅜in L x 2in H x 1¼in W.



FILTER CHOKES

	Retail Price
TC 66 14/60	10/6
TC 66 Windings only.	6/6

SPEAKER TRANSFORMERS

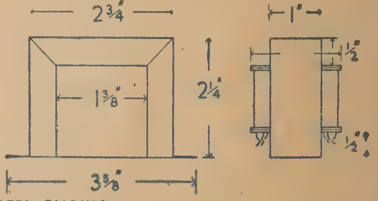
Type	Primary Ohm	Voice Coil Ohm	
TS 23 Single Triode	3500	2.3	16/-
TS 24 Single Triode	3500	3.9	16/-
TS 25 P/P Triode	3500	2.3	16/-
TS 26 P/P Triode	3500	3.9	16/-
TS 27 Single Pentode	5000	2.3	16/-
TS 28 Single Pentode	5000	3.9	16/-
TS 29 P/P Pentode	5000	2.3	16/-
TS 30 P/P Pentode	5000	3.9	16/-

SPEAKER REPLACEMENT WINDINGS

F 132 Single Triode	3500	2.3	7/-
F 133 Single Triode	3500	3.9	7/-
F 134 P/P Triode	3500	2.3	7/-
F 135 P/P Triode	3500	3.9	7/-
F 136 Single Pentode	5000	2.3	7/-
F 137 Single Pentode	5000	3.9	7/-
F 138 P/P Pentode	5000	2.3	7/-
F 139 P/P Pentode	5000	3.9	7/-

CHOKES AND TRANSFORMERS

Size: Core Section 7/8in x 7/8in 15 watts
o/all sizes 2¾in L x 2in H x 1⅜in W.



FILTER CHOKES

	Retail Price
TC 60 100 M/A 30 H	17/8
TC 70 75 M/A 50 H	18/-
TC 65 50 M/A 30 H	16/4
TC 58 L/T 3 amp 50 M/H Vib.	17/6

AUDIO TRANSFORMERS

TB 42 A Class 3 to 1	27/-
TB 43 A Class p/p 3 to 1	28/-
TB 44 B Class p/p 1½ to 1	27/-

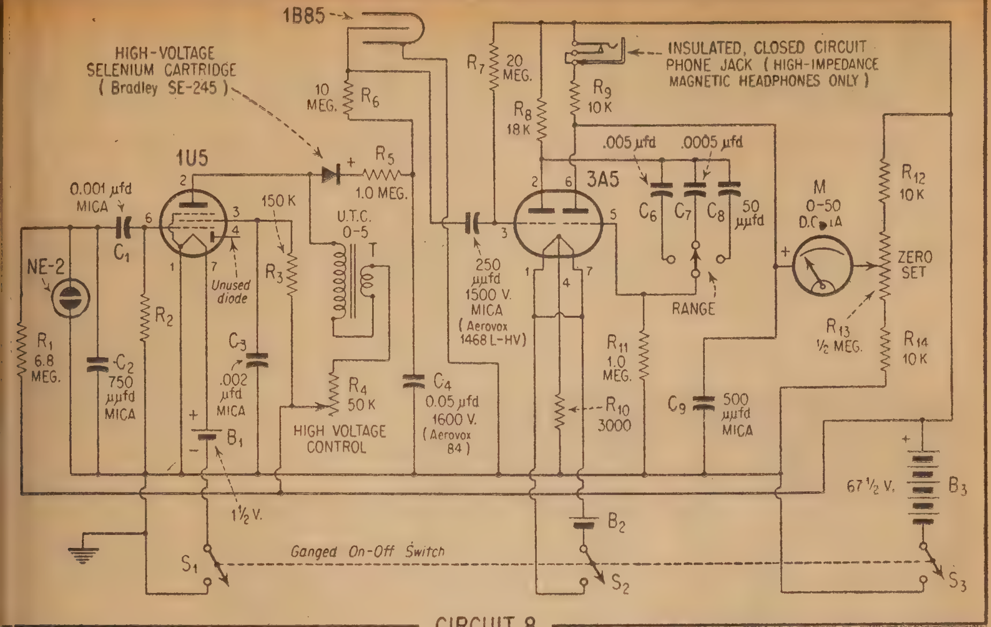
AUDIO CHOKES

TA 4 100 H 1000 ohms	21/-

FILAMENTS AND AUTO TRANSFORMERS

TP 53 2.5 v 5 amp	23/-
TP 54 4.0 v 3 amp	23/-
TP 55 6.3 v 3 amp 15 watt	20/6
TP 80 6.3 v 4 and 2.5 auto	18/-
TP 56 12.0 v 1.5 amp	23/-
TP 57 18.0 v 1.0 amp	23/-
TP 58 240 v 0.5 amp	23/-

R.C.S. RADIO PTY. LTD., 651 FOREST RD., BEXLEY, N.S.W.



CIRCUIT 8

s the 1B85 tube fires under the fluence of penetrating radioactive icles, the resulting pulses are ented to the grid of the 3S4 amlier tube, and the amplified pulses delivered to the headphones.

ne 1½-volt battery, B1, supplies o the transformer and the 3S4 lament. The 22½-volt battery, B2, plies only the plate and screen of e 3S4. For light-duty application, l nay be a single size D flashlight el and B2 a hearing-aid battery.

XCTING WORK

or more exacting work, B1 should e nade up of two or more size D s connected in parallel, and B2 ould be a midget 22½-volt radio- B-battery.

s in Circuit 5, the length of time t the capacitor will remain charged will depend upon ambient humidity and capacitor leakage and usually be between 5 and 30 minutes. occasional succession of rapid ings of the pushbutton switch, l will restore the charge.

RCUIT 7.—This geiger counter a a self-contained, miniature, ator-type power supply operated a a single 1½-volt size D flashlight el. The vibrator unit supplies the B5 counter tube and the 3A5 dualide amplifier tube. Meter readings, as well as headphone signals, obtained with this circuit.

ne miniature virbator unit is a el 10MVT, a product of Precise surements Co., Brooklyn, N.Y. It sists of a virbator integral with a -voltage transformer. The sparkpressing capacitor, C1, is selfained.

he high-voltage AC output of he transformer is rectified by two u-miniature high-voltage selenum cartridges. One of these, SE1, s poled to supply positive output the 3A5 tube.

ne other, SE2, is poled for negaiv output for the 1B85. The 50-microfarad, 150-volt electrolytic capacitor, C4, filters the 3A5 voltage, and its normal leakage holds this voltage approximately to 80 volts at 200 microamperes.

The Victoreen Type 5841 regulator tube holds the counter tube voltage to a constant 900-volt level. Capacitors C2 and C3 and resistor R1 form the high-voltage filter.

The 3A5 tube provides a 2-stage RC-coupled amplifier. The output triode is capacitance-coupled, through C6, to a rectifier-type voltmeter, comprised by the 1N34 diode and the 0-50 DC microammeter, M.

The meter deflection is proportional to the number of pulses per unit time arriving from the counter tube. Its scale may be calibrated at various settings of potentiometer R5 (which might also be a step-type attenuator) with the aid of a series of calibrated radio-active samples held close to the 1B85 tube.

Magnetic-type headphones inserted into the phone jack will provide aural indications. Since this jack is of the close-circuit type, it will restore the plate circuit of the second triode automatically when the headphone plug is extracted.

CIRCUIT 8. This circuit employs a 3A5 dual triode in a cathode-coupled one-shot multivibrator circuit. The multivibrator is triggered by pulses from the 1B85 counter tube. Each pulse switches the multivibrator on and off, causing a single pulse to be delivered to the metering circuit.

Capacitors C6, C7, and C8, switched into the circuit, alter the pulse duration and repetition rate of the multivibrator and thus change the meter range. The microammeter thus is provided with several "total count" ranges.

The microammeter scale accordingly may be calibrated in counts per unit time, milliroentgens per hour, or similar units. For this purpose, a series of calibrated radio-active samples may be employed.

Like a VT voltmeter, the meter is set initially to zero in the absence of any input signal, by adjustment of potentiometer R13. An aural indication is obtainable from magnetic-type headphones plugged into the closed-circuit jack.

This multivibrator-type Geiger counter circuit is adapted from a similar one developed by Friedland. (See Radiological Monitoring, Stephen S. Friedland. QST, June, 1951, Page 29.)

The 900-volt potential for the counter tube is developed by a special power supply based upon a neon-bulb relaxation oscillator. Operated from the same 67½-volt battery, B3, that furnishes the 3A4 plate voltage, the relaxation oscillator consists of resistor R1, capacitor C2, and the NE-2 neon bulb.

SAWTOOTH VOLTAGE

The sawtooth voltage developed by this oscillator is applied to the grid of the 1U5 tube. A choke coil, consisting of a miniature "Ouncer" transformer, T, with its primary and secondary connected together in series-aiding, is connected in series with the 1U5 plate.

The rapid fall of current through this choke, due to the decay ("flyback") of the sawtooth wave, induces a high voltage across the choke. This high voltage then is rectified by the high-voltage selenium cartridge, filtered by R5 and C4, and applied to the 1B85 tube.

The high-voltage DC may be set exactly to the required level of 900 volts (preferably with the aid of an electrostatic voltmeter) by adjustment of potentiometer R4.

A separate 1½-volt cell, B2, is required for the 3A5 filament, since the cathode-coupled circuit in which this tube is used requires that the filament "float" 3000 ohms above ground. B1 and B2 are Size-D flashlight cells. B3 is a radio-type 67½-volt B-battery.

A COURSE IN TELEVISIO

PART SEVEN—VHF PROPAGATION AND AERIALS

Because television programmes are radiated on frequencies between about 50 and 200M
special aerial systems have to be used. This article and the one to follow explain why th
is so and shows, further, how basic VHF aerial designs have been modified and extende
to meet the peculiar requirements of television broadcasting.

If all readers were licensed amateurs, the job of explaining television aerial systems would be greatly simplified, because one could assume a working knowledge of VHF propagation, dipoles, aerial arrays, transmission lines and such like.

To many readers, however, these are just terms, and rather mysterious terms, at that. They have never had occasion to worry about propagation conditions or aerial systems, other than those encountered with ordinary broadcast and short-wave services.

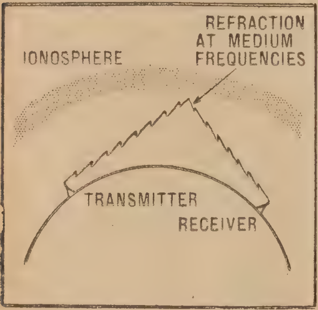


Figure 42: Illustrating the bending effect of the ionosphere on radio waves up to a frequency of about 30 Mc. This makes reception possible over great distances, though it does also lead to the familiar fading effects.

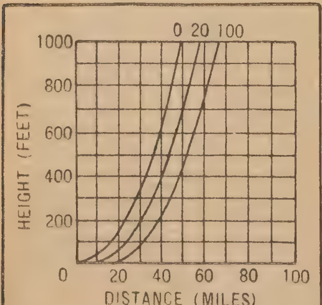


Figure 44: This graph shows the anticipated range of a particular VHF transmitter plotted in miles against an aerial height in feet. The curves are for different heights of receiving aerial.

We propose, therefore, to extend our treatment of the subject, as was done in the original course, to cover these basic principles and ideas. This first article should therefore provide background not only for the present course, but for studies in FM, radar, or any other subject involving transmission in the VHF or UHF bands.

Before becoming involved with the actual design of aerials, it may be as well to say something about the propagation characteristics of VHF signals, as distinct from signals radiated at lower frequencies.

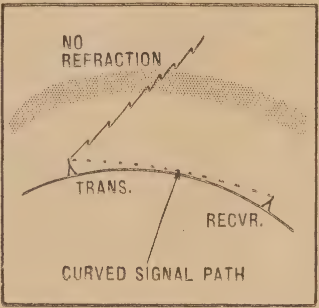


Figure 43: VHF signals are not refracted or reflected by the ionosphere, except in special circumstances. A direct path is the only useful one, so that reception is limited to a little more than a line-of-sight range.

On the medium-wave broadcast band, signals may travel from transmitter to receiver by a direct path along the earth's surface or they may be refracted (or reflected) by the ionosphere, as shown in figure 42.

The ultimate coverage of a broadcast station depends a good deal on radiated power, on terrain, weather conditions, time of day, and so on, but useful signals may often be received over a distance of several hundred miles.

The bending effect of the ionosphere is vital also to long-distance short-wave communication, but it becomes much less apparent in the region of 30-50 Mc.

Beyond this limit the only useful signals are generally regarded as those which travel direct from transmitter to receiver along the surface of the earth. Energy radiated upward from the aerial is therefore wasted. (Figure 43.)

A further point is that these higher frequency signals tend to behave
more and more like light beams,
velling most easily in a straight

Hills and buildings can pro
shadow and reflection effects
optimum conditions exist for re
tion where there is a clear lin
sight between the transmitting
the receiving aerial.

Actually, the range of a VHF tr
mitter does exceed the strict line
sight definition because local re
tions and the refractive effect of
atmosphere do tend to fill in l
hollows and to extend the ove
coverage by an appreciable amo

FAVORED SITES

It follows that, for best cover
a VHF transmitter must be locate
the highest possible position
most favored sites are on hilltop
tall buildings overlooking the
to be served. (The sites selected
Australian television stations in
capital cities, obviously, conform
this requirement.)

Figure 44 shows the anticip
range from a given VHF transmi
plotted in miles against the he
of the transmitting aerial ab
ground level.

The respective curves are for
ferent heights of receiving aeri

It is evident from these cu
that a high position is also desir
for the receiving aerial both to
proach the line-of-sight condition
to get the aerial clear of surroun
objects.

We shall have more to say l
about aerial placement.

Another matter which is most
portant in the VHF region is tha
signal polarisation.

A radio wave consists of elec
magnetic and electrostatic fields
right angles to each other and
polarisation of the wave refers to
relationship of the electrostatic
to the earth's surface.

If the electrostatic field is ver
with respect to the surface of
earth the wave is said to be vertic
polarised. Conversely, if the elec
static field is parallel to the ea
surface the wave is said to be h
zontally polarised.

The polarisation of the wave
determined initially by the trans
ting aerial.

While there are special except
it generally works out that a h
zontally polarised wave is radi
by an aerial whose active elem
are parallel to the earth's surf
Vertical elements give vertical po
isation — again with special ex
tions.

For best signal pickup, the
ceiving aerial must be designed

ve the same polarisation as the nsmitting aerial. This means that must be installed with its active ments deliberately parallel with or tical to the earth's surface, whichever is required.

The standards stipulate that Australian television stations shall radiate a horizontally-polarised signal for both vision and sound channels, so that all local receiving aerials will have to be designed and installed accordingly.

Readers may well have inferred from the foregoing remarks that there is something special about an aerial designed for the reception of VHF signals, and such indeed is the case.

AERIAL DESIGN

For normal broadcast listening and even a good deal of short-wave reception, our ideas of a receiving aerial have largely been restricted to a length of wire tacked around the picture rail or strung to a nearby tree.

No special attention is paid to aerial height and length, apart from the general idea that increasing the length and height of an aerial increases the signal pickup and vice-versa.

In general, this simple approach is quite permissible, because an unpretentious aerial can usually pick up sufficient signal on the broadcast band for an ordinary set to amplify to the required degree.

With higher signal frequencies, however, the position alters and the following factors emerge:

(1) It becomes progressively more difficult to achieve high gain in the receiver and

(2) It becomes possible, because of the shorter wavelengths, to use aerials which are naturally resonant at the signal frequency. Such aerials supply the receiver with an input signal much larger than would otherwise be the case.

(3) By the addition of simple reflecting or directing elements, it is possible also to concentrate the pick-up area of an aerial in a specific direction, reinforcing the desired signal and discriminating against interference.

DIPOLE AERIAL

The simplest resonant aerial is known as a half wave "dipole". This consists of two wires or rods each approximately ¼ wavelength long, mounted end to end, but with a gap of approximately 1in or less between ends (see figure 45).

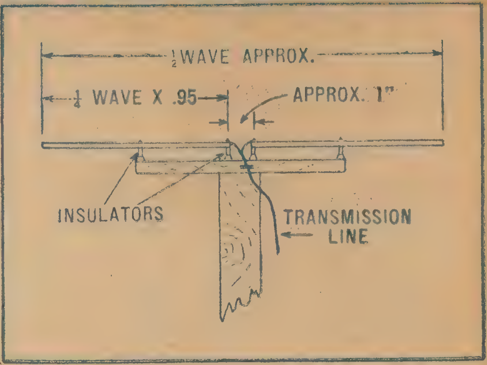
Although referred to as a half-wave dipole, the length of each component arm is normally about 5 pc less than the calculated length of a quarter wave corresponding to the frequency for which the aerial is cut.

Thus, the procedure in designing a half-wave receiving dipole is first of all to decide on the frequency for which it is to be cut and then, by dividing megacycles into a figure of 300, to determine in metres a figure for one wavelength. Dividing this figure by four will give you the length of an electrical ¼ wave.

The correction factor of 5 pc mentioned above makes it necessary to multiply the electrical ¼ wavelength by a factor of .95 to give the length of each component section of the dipole.

BASIC DESIGN OF A VHF DIPOLE

Figure 45: The essential dimensions of a simple dipole aerial. Such aerials are practical in the VHF and UHF bands because the wavelengths involved are quite short. A dipole aerial will intercept signals near its resonant frequency far more efficiently than a longer but random length of wire.



CORRECTION FACTORS FOR ROD HALF-WAVE AERIALS

Mc.	Diameter	Factor
166	¼ inch	.995
	⅜ inch	.985
	½ inch	.975
	1 inch	.965

A typical set of correction factors based on length/diameter ratio for a frequency of 166Mc.

When converting to inches it is necessary to remember that there are 2.54 centimetres to the inch and 30.48 centimetres to the foot. One metre is equal to 39.37 inches.

Actually the conversion into feet can be accomplished automatically by dividing the frequency in megacycles into 246. Taking into consideration the 5 pc correction factor, the length of each half of the dipole can be calculated directly in feet by dividing 234 by the frequency in megacycles.

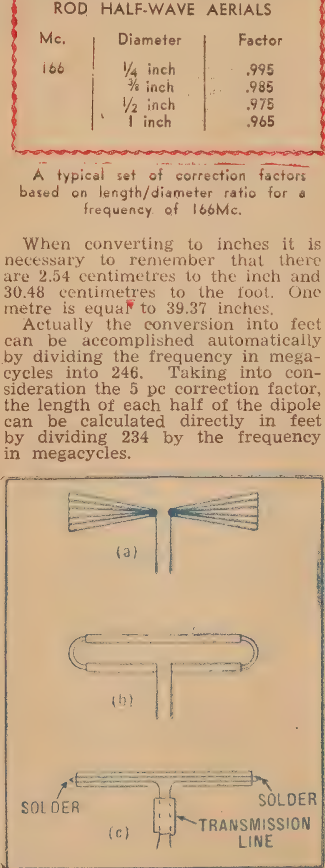


Figure 46: A dipole aerial with conical rather than tubular elements is receptive to a wider range of frequencies. The same is true of a folded dipole made up from tubing as in (b) or from a length of twin transmission line (c) attached to a supporting dowel.

By way of example we may desire to erect a dipole aerial which is resonant at 200 mcs. This corresponds to a wavelength of 1.5 metres, so that an electrical ¼ wave corresponds to 0.375 metres. The 5 pc correction then gives a figure of approximately 0.356 metres. Converting to inches, the answer is very close to 14.

Using the simplified formula, the same answer is obtained by dividing 234 by 200, to give 1.17 feet or 14 inches.

Thus a half-wave dipole for 200 mcs. would consist of two 14in rods or wires mounted end to end, with a gap at the centre of one inch or less, depending mainly on the bulk of the supporting insulators.

FURTHER CORRECTION

Where greater accuracy is required, further allowance can be made for the diameter of the aerial rods, based on their length-to-diameter ratio. This compensation becomes quite significant in arrays where, for reasons yet to be explained, the aerial elements are made quite bulky.

A dipole aerial, designed as above and suitably mounted in a prominent position, can pick up signals at its resonant frequency far more efficiently than a much longer but random length of wire.

Therefore, because the physical size of a dipole aerial diminishes to manageable proportions at these higher frequencies, the use of dipoles or similarly devised resonant aerials is accepted practice for the VHF and UHF spectrum (i.e., for frequencies above about 30Mc).

One important difficulty which arises, however, is that the efficiency of a dipole progressively diminishes when it is used to intercept signals at frequencies removed from its own natural resonance. It is virtually the same property which causes a tuned circuit to discriminate against signals other than the one to which it is tuned.

The degree of discrimination—or the sharpness of tuning, may be related in each case to the "Q" factor.

Amateur station operators encounter the problem in a minor way, because their aerial systems may have to operate at any frequency

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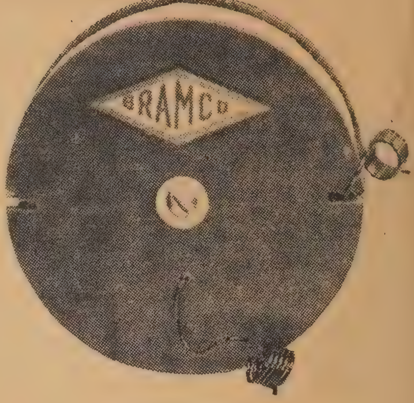
FOR ALL TYPES AND CIRCUITS

For correct operation of filter and loud speaker network, the right value and type of inductance is essential.

Bramco inductances are designed to do just the job you have for them. They may be supplied in standard values, or wound to any specifications you may require. Each is carefully checked before leaving the factory, and exact figures can be supplied if necessary.

There is a Bramco inductance for use with cross-over networks as designed by all the popular makes of speakers, such as Goodmans, Wharfedale etc.

Bramco also specialises in high quality output transformers for high fidelity amplifiers and circuits, featuring wide range, hermetic sealing, terminal connections etc. Let us quote for your requirements.



A Bramco inductance for use in loudspeaker cross-over networks of the type described in the article in this issue. Single-hole mounting is provided.

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THE BJ ARM

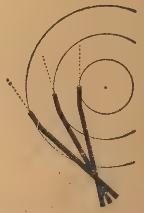
Technical Report by P. WILSON, M.A., *quoted from* THE GRAMOPHONE:

It is beautifully made, and indeed is an example of precision workmanship. Notwithstanding the four extra pivots, the lateral motion is without play and as sleek as velvet.

In addition, stylus wear will be reduced and becomes more of the nature of a polish, not only by the better seating of the stylus in the groove but also because it will now track with reduced pressure. This in its turn will decrease record wear.

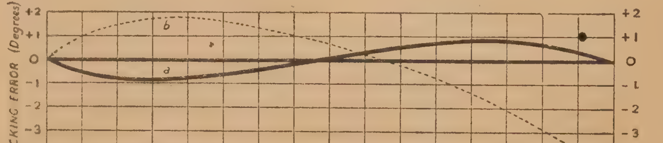
These virtues are not mere theoretical deductions. They are readily observable in test conditions. In particular, the crispness of the response, especially in the bass, and the increased articulation and resolution of different instruments in orchestral records are easily discernible. . . .

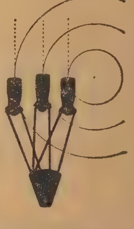
It will be gathered from all this that I am enthusiastic about this BJ Arm. I am indeed. It is certainly the most satisfactory swinging arm that I have ever seen.



INCORRECT TRACKING with Conventional Arm.

Below: TRACKING ERROR CURVE (a) The BJ arm (b) Conventional bent arm.





PRECISION TRACKING with the BJ Arm.

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in a specified band. As we l see a little later, the problem omes acute when an aerial sys- has to be designed to receive vision stations operating on ely separated channels.

ome reduction in the "Q" factor . dipole, to broaden its response, be achieved by building its ele- ts from large diameter tubing, plying a suitable correction factor, lready mentioned.

till another method, as shown in re 46a, is to construct the dipole n a series of rods or from sheet al to produce a conical form.

igures 46b and 46c suggest yet ther type of broad-band aerial, ely the folded dipole. In this two or more rods are used and lged across at the ends. One rod roken at the centre, as in the ple dipole, for the insertion of feed line.

MENT LENGTH

he length of the individual elements is taken as being from the tre point of the junction at one to the centre point of the junc- at the other. It is normally al to a half wavelength, less correction quantities already ntioned for end-effect and length/ neter ratio.

efore saying any more about als, however, it may be wise to ess again and interpolate a few arks about aerial impedance and relationship to the ways and ns of connecting a VHF aerial the receiver.

ere again, many readers may find mselves on unfamiliar ground , by advancing step by step, it uld be possible to assimilate the damentals easily enough and, r, to see how they are extended adapted to meet the requirements of a domestic television aerial tem.

he term "aerial impedance" will foreign to those who have thus had dealings only with ordinary ials.

NDOM QUANTITY

While it will be appreciated that h aerials must have a certain ount of inductance, capacitance resistance, the ultimate figure impedance which these properties ght produce at a given frequency as random as the aerial's length height.

owever, the moment that an ial is made resonant at the signal quency, its characteristic imped- e can be stated and, indeed, must taken into account if proper con- tion is ultimately to be made to receiver.

he subject of characteristic im- lance can become extremely com- x with multi-element arrays but presents no special difficulties in simple dipole.

As mentioned earlier, a resonant ole can be regarded fundament- y as a tuned circuit, involving L, and R.

When excited by a signal at its sonant frequency, a dipole exhi- s a distribution of voltage and rrent along its length, which is rmally depicted as in figure 47. it will be seen that the intensity the alternating signal current flow is greatest at the centre, dropping to near zero at the ends. Conversely, the peak signal voltage with respect to earth reaches a maximum value at the ends but drops virtually to zero in the centre.

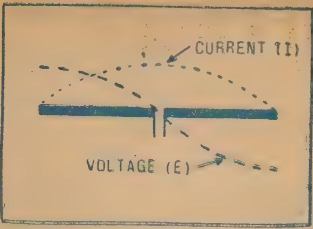


Figure 47: The distribution of current and voltage along a resonant half-wave dipole. The impedance is minimum at the centre, where I is high and E is low. Folding a dipole or adding elements to achieve a beaming effect changes the impedance values.

At all points along a dipole, therefore, there is a specific relationship between the instantaneous voltage and the instantaneous current and this can be expressed as the characteristic impedance of the aerial at that point. It is necessary only to recall Ohm's law, which states that R equals E/I.

At the ends of a dipole "E" is high and "I" is low, so that "R" must obviously be high. Conversely, at the centre of a dipole "E" is low and "I" is high, so that the centre is the point of lowest resistance (or impedance, to be somewhat more precise).

Fortunately, these observations can be resolved into quite simple figures which apply to all dipole aerials. The following general statements can be made:

(1) The impedance at the centre of a simple dipole, operating at its resonant frequency, approximates 73 ohms.

(2) The impedance at the ends of a simple dipole, operating at its resonant frequency, approximates 3000 ohms.

(3) The impedance at points intermediate between the centre and the ends will lie between the figures suggested in (1) and (2).

MAY VARY SLIGHTLY

Actually, the precise values vary somewhat with factors such as the height of the aerial above ground, but the figures quoted are usually accepted as a basis for calculation and design.

It is important to remember that they apply only for the frequency at which the dipole is naturally resonant or at least within the range of adjacent frequencies to which the aerial may be regarded as being responsive.

The lead wire connecting the aerial to the receiver must be suitably chosen if proper signal trans-

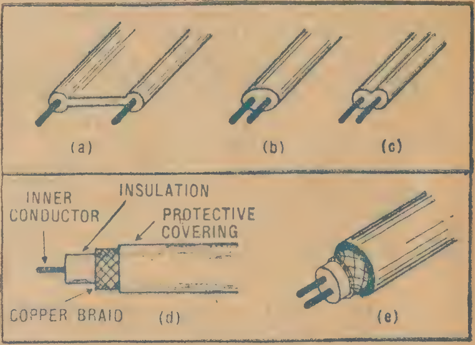


Figure 48: Sketches (a), (b) and (c) illustrate the appearance of typical plastic-insulated twin transmission line, as commonly used for TV receiver installations. Sketch (d) shows the construction of ordinary coaxial cable, while (e) illustrates the less common twin shielded line.

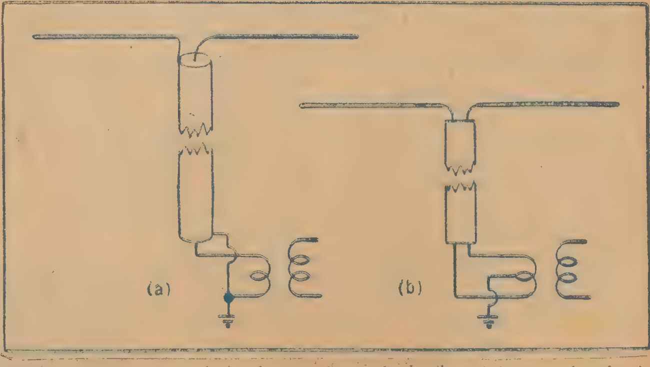
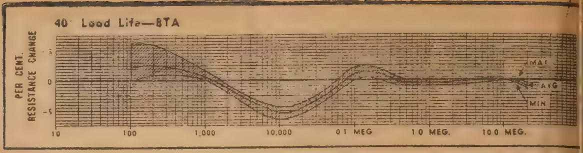
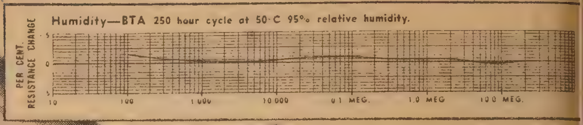
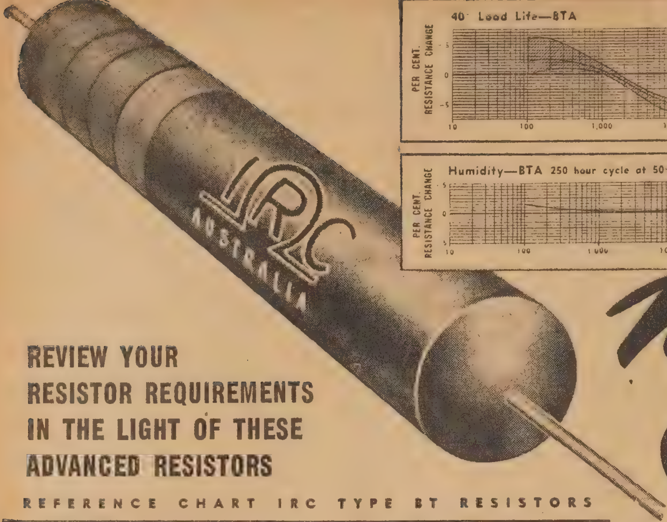


Figure 49: Common methods of connecting a dipole element to a receiver input circuit (a) by coaxial line and (b) by a balanced twin line. The balance in circuit (a) can be improved by adding a "stub" to the aerial end of the coaxial line.







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10	•	•	•	—	100	1,000	10,000	0.1	1.0	10.0
11†	•			—	110	1,100	11,000	0.11	1.1	11.0
12	•	•		—	120	1,200	12,000	0.12	1.2	12.0
13†	•			—	130	1,300	13,000	0.13	1.3	13.0
15	•	•	•	—	150	1,500	15,000	0.15	1.5	15.0
16†	•			—	160	1,600	16,000	0.16	1.6	16.0
18	•	•		—	180	1,800	18,000	0.18	1.8	18.0
20†	•			—	200	2,000	20,000	0.20	2.0	20.0
22	•	•	•	—	220	2,200	22,000	0.22	2.2	22.0
24†	•			—	240	2,400	24,000	0.24	2.4	—
27	•	•		—	270	2,700	27,000	0.27	2.7	—
30†	•			—	300	3,000	30,000	0.30	3.0	—
33	•	•	•	—	330	3,300	33,000	0.33	3.3	—
36†	•			—	360	3,600	36,000	0.36	3.6	—
39	•	•		—	390	3,900	39,000	0.39	3.9	—
43†	•			—	430	4,300	43,000	0.43	4.3	—
47	•	•	•	—	470	4,700	47,000	0.47	4.7	—
51†	•			—	510	5,100	51,000	0.51	5.1	—
56	•	•		—	560	5,600	56,000	0.56	5.6	—
62†	•			—	620	6,200	62,000	0.62	6.2	—
68	•	•	•	—	680	6,800	68,000	0.68	6.8	—
75†	•			—	750	7,500	75,000	0.75	7.5	—
82	•	•		82	820	8,200	82,000	0.82	8.2	—
91†	•			91	910	9,100	91,000	0.91	9.1	—

* Shows values available in tolerances indicated.
† 5% values only; 10% & 20% values NOT available.

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is to be affected. It carries name "transmission line" or d line" and usually involves two rate conductors arranged either e parallel or concentric.

most cases, the transmission is connected to the centre point he aerial, one conductor to each he elements.

he aerial provides the "load" or ination for the transmission line , ideally, the aerial impedance at point of feed should provide the ropriate terminating impedance the type of transmission line ch is selected.

n the simplest case, where the al is resonant dipole, the centre edance is about 73 ohms and figure has to be taken into ount when attaching the trans-sion line.

FERENT FIGURES

ore complex aerials exhibit dif-nt impedance figures which can ally be ascertained from aerial ign data.

olding a dipole, for example, tiplies the normal dipole input edance by a factor of four times, ch thus steps it up to 4 x 73 als 292 ohms.

y making up a folded dipole ing three or more parallel rods, by using rods having different neters, a wide range of effective edance figures can be achieved.

he ability to multiply impedance res in this fashion is valuable in igning beam arrays, where the ition of extra elements can easily uce a dipole's natural impedance a figure which would otherwise embarrassingly low. We shall e more to say about this a little r.

he designer of a complete VHF ial system thus starts off with a wledge of the transmission lines ilable and the general type of ial he wants to use. It is then natter of compromise and adjust-nt to derive an acceptable aerial ich will exhibit an input im-ance to match the required term-nting impedance of a suitable line. Now for a brief discussion of nsmission lines.

AT LINE

or receiving purposes, the usual n is to employ an electrically t line". This is achieved by king sure that the characteristic surge impedance of the line is same as at the feed point on aerial and also at the coupling l of the receiver or transmitter.

When this condition is achieved transmission line can be of any venient length and there should no noticeable variation in results he line is made longer or shorter reasons of convenience.

he characteristic impedance of a nsmission line is determined by diameter of the conductors, the cing between them and the ure of the intervening material e it air or solid insulation.

he exact figure can be calculated appropriate formulas but the rage enthusiast is usually satis-d to accept published figures for es of different type.

he most elementary transmission consists simply of two wires side by side and spaced evenly h suitable insulating blocks. This referred to in textbooks as an en wire" transmission line and

A THREE-ELEMENT BEAM AERIAL

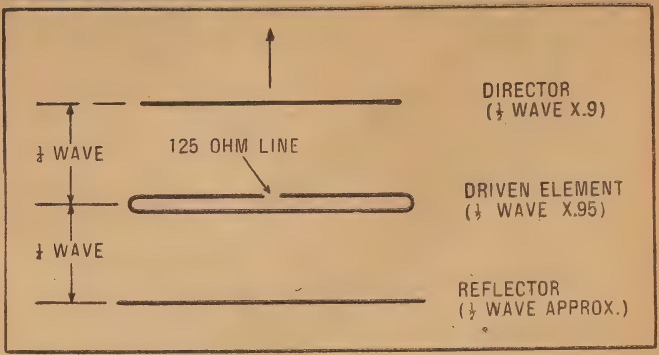

Figure 51: The essential dimensions of a three-element wide-spaced beam. Centre impedance is about 30 ohms with a central dipole or about 120 ohms for a folded dipole, as shown. Beams of this type are frequently used by amateur station operators but they can also be used to obtain better reception of a particular TV station from fringe areas.

tables have been published showing characteristic impedance of lines made up using certain gauge conductors and spacing.

Actually, the characteristic or surge impedance is determined by the relationship of inductance and capacitance per unit length and this is a function of wire diameter and spacing.

TWIN LINE

Another type of transmission line consists of two parallel wires moulded into a continuous ribbon of low loss plastic (see figure 48). Typical impedance values available are 75, 150 and 300 ohms.

Again, the popular plastic flex used so widely for 240 volts AC leads, makes quite a useful transmission line provided matters are arranged to utilise its characteristic impedance of 150-odd ohms.

All these transmission lines are inherently balanced by reason of the fact that both conductors have approximately the same capacitance to the aerial, to earth and to surrounding objects.

The best example of an unbalanced transmission line is the so-called "coaxial" cable. This, in its most popular form, consists of an inner conductor surrounded by low loss plastic with an outer conductor of copper braid. Over this again there is usually an outer plastic layer for protection against abrasion and weather (figure 48d).

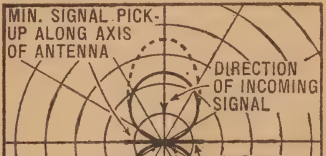
MIN. SIGNAL PICK-UP ALONG AXIS OF ANTENNA
DIRECTION OF INCOMING SIGNAL
ANTENNA

Figure 50: This plan drawing illustrates (solid curve) the directional qualities of a simple dipole. Addition of a reflector element and possibly a director, as in figure 51, gives the uni-directional response pattern shown dotted.

The characteristic impedance of a coaxial line is dependent on the diameter of the inner conductor, the distance to the outer conductor and the characteristics of the insulating layer. Most common values are 55 and 75 ohms.

The older varieties of coaxial cable had beads spaced at intervals rather than solid insulation, between the conductors.

Cable has also been manufactured with two parallel conductors inside an outer braiding thereby combining the characteristics of balanced and coaxial lines. (Figure 48e.)

MATCHING IMPORTANT

Broadly speaking, any of these transmission lines can be used as the link between the aerial and receiver input the most important point being to see that some degree of matching is achieved between all three.

Figure 49 illustrates typical ways of interconnecting a dipole aerial, a transmission line and the aerial input circuit of the receiver.

Circuit (a) is not completely symmetrical as it stands because of the different capacitance effects between the aerial and the inner and outer conductors. Circuit (b), using a twin line, is symmetrical and is the arrangement most frequently selected for domestic receiver installations.

All practical transmission lines introduce some losses, which are usually expressed in the relevant data as so many decibels per 100ft. The losses are due to RF resistance in the conductors and RF leakage through the insulation. Except in cases where very long runs are involved or where the signals are initially very weak, line losses are not likely to be important in domestic receiver installations.

To conclude this present discussion of the elements of VHF aerial design, mention must be made of the directional qualities of such aerials.

(Continued on Page 113)

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TRADE REVIEWS AND RELEASES

DVANCED RECORD PLAYING EQUIPMENT FROM DUAL

record changer and a record layer, both with advanced naracteristics, have recently een added to the well known Dual range.

IE of the difficulties in designing a record changer or an auto-ic record player is to engage stylus accurately with the run-groove on the outside of the rd. If the pickup arm descends ide of the record, it may be aged by contact with the turn-le or if it descends too close to centre spindle, the beginning of recording will be missed.

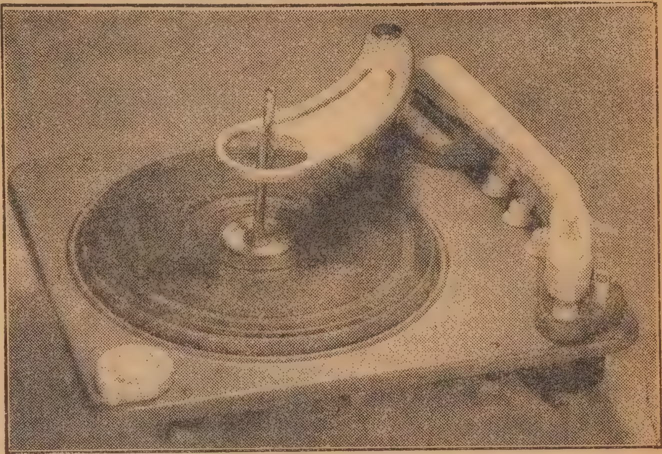
ual have produced a novel hanical system which obviates n possibilities.

hen the button to start the hanism is pressed the arm lifts n moves across toward the centre he record and then gently lowers lf on to the surface. At this e, the stylus does not touch the ord but rather a specially-shaped e which rides over a number grooves.

he arm is guided gently to the side of the record, when as soon the piece previously mentioned os over the edge, a trip device brought into action which re-ts it and allows the stylus to age with the run-in groove. The ord is then played in the normal . At the end of the recording usual record changer mechanism ks and the action is repeated the next disc.

he feature of this system is that precise diameter of the record not important. Whether it be 10in or 12in, the stylus will dropped into the groove in ex-y the right position.

he mechanism is brought into on by pushing one of two but-s. The microgroove button auto-tically brings the small radius us into position and the normal ton the larger diameter stylus 78 rpm recordings. This is operated by a connecting linkage through the pickup arm.



The mechanism of a watch is simple when compared with that of a modern record changer. This new unit from Dual is one of the most foolproof and reliable we have seen to date. It will play all types of recordings.

Therefore, to play a recording or recordings, you simply load the changer in the usual way, select the correct speed from 33 1-3 rpm, 45 rpm and 78 rpm and press either the microgroove or normal button.

Additional features of the changer are provision for treble cut for playing worn recordings, a mechanism to provide a delay between records and a device to allow the record being played to repeat.

The mechanism of the changer is, naturally, very complicated but appears to be very well engineered. The sample supplied for test operated with complete reliability.

The record changer is designated type 1003 and retails at £35/12/6, but a record player of similar design (type 280) is available at £24/15/-. A large diameter centre spindle is supplied with each player and this allows it to function as an automatic changer for the 45 rpm recordings only.

A crystal pickup is fitted in both cases and when fed into a 1 megohm load the response characteristics for microgroove and 78 rpm standard respectively are such that no special equalising is required.

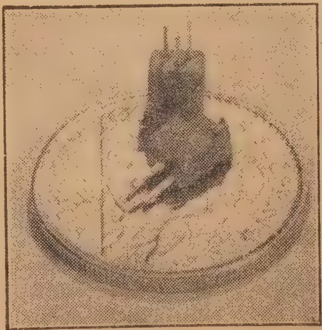
Our sample from Fred. A. Falk and Co. Pty. Ltd., 28 King St., Rockdale, NSW.

SPECIAL SOCKET FOR TRANSISTORS

HILIPS Electrical Industries Pty. Ltd. have introduced a socket ich is especially suitable for junc-n transistors such as the OC70 and OC71. The sockets fit a rect-gular hole 6.3 x 4.3 mm and are f locking due to the tapered sides. e body material is a tan-colored thetic resin with good high fre-ency properties so that the sockets y be useful if high frequency nsistors become available later.

ontact is made by three silver-ted phosphor bronze springs en-ring low contact resistance and e of soldering.

The retail price is 1/5 each.



he new Philips transistor socket will e of great assistance to experimenters. he normal long leads of the transistor are cut off to about ¼ inch.

VERSATILE TAPE

SUPERSEDING an earlier type, "Scotch" No. 39 electrical tape has many qualities which will make it popular with industrial users.

It is pressure sensitive and may be used after the manner of the familiar cellulose tape. However, it has the additional advantage that the adhesive material is thermosetting so that a firm insulating layer can be easily obtained automatically in the usual oven processes. The adhesive bakes firm after oven curing at 300 degrees F for one hour or 250 degrees F for two hours, after which it has a high solvent resistance.

The tape is .005in thick and made from an electrical grade rope paper, yellow in color.

Although the sample supplied was only 3-8in wide it could be torn with the fingers only with effort. Some stretch is available before the breaking point to enable projections and other irregularities to be negotiated without breaking the continuity of the insulation. Other standard widths are ½in, ¾in and 1in.

Detailed information is available from Wm. J. McLellan and Co. Pty. Ltd., 126 Sussex St., Sydney.

OFF THE RECORD — NEWS & REVIEWS

The procession of operatic recordings continues, so much so that I have to ration them ou
over the issues. Most notable are further issues by Columbia starring Madame Callas, wh
is the artist featured in quite a number. One hopes there is no danger of having too muc
of a good thing.

by John Moyle

BELLINI — Norma, Opera in Two Acts, with Maria Meneghini Callas, the Chorus and Orchestra of La Scala Opera House, Milan conducted by Tullio Serafin. Columbia 33CX1179-1181.

Norma is the story of a High Priestess of the Druids who, falling in love with a Roman Pro-Consul, bears him two children. Later he deserts her and falls in love with another Priestess whom he attempts to abduct when she spurns him on learning he has been the lover of Norma. After much emotional and loud singing, Norma confesses her guilt to the people, and her ex-lover, reformed by her display of nobility, joins her at the funeral pyre on which their joint guilt is expiated, declaring themselves "purified and happy in their new-found adoration".

Probably the only people who ever made such an astounding declaration as they sizzled in the flames.

The story, however, is quite a credible one for those days, and leads to countless opportunities
vocal emoting in the good old
that made opera what it was.

Bellini was the master with
lush, melodic opera. Listening t
it is easy to see where the foun
tions of Verdi were laid, altho
Verdi left this style far behin
his later work, whereas Be
maintained it through his comp
tively short career.

Whether you will like this rec
ing will depend almost entirely
whether you like M. M. Callas
dominates the work, not only as
central figure but because artisti
and vocally she is head and shoul
over the remainder of the cast.

One of them, the bass who s
Oroveso the High Priest, is so
that when he sings it's hard to as
tain the pitch of the note he is
ducing.

The tenor has a good voice,
quate for the part. The young Pr
tess is sung by Ebe Stignani,
must be in her fifties, and altho
on those grounds we must ad
her performance, she just can't
those extra years to make the
convincing.

FINE PERSONALITY

There is no doubt about the
sonality and artistic sense of Ca
On the stage she must be qui
presence. But as a recording a
she is unfortunate.

Her voice in this recording cle
shows its remarkable ability to so
like four different women in
different sections of her range.
upper registers are strong, pure
magnificent. But as she goes d
the scale, she takes in some pec
husky tones which are as ugl
they are disconcerting.

After an hour of it, I began to
her oppressive.

The effect is heightened bec
the recording, made in a hall
separate mikes for all, sounds ex
that way. One can picture the
formers all standing around t
desks meeting their cues with
sense of movement or action.

It makes some fine recording,
it doesn't help to put life in
bones.

I'd like to have been more fla
ing about this set, and I've list
to it faithfully just in case. T
nically it's quite good — very go
but Callas carries it on her should
and unless you happen to admire
singing there's not much else

**PUCCINI—Tosca, an opera
three acts, with Maria Men
ghini Callas. Guiseppe di St
fano, Tito Gobbi, and the O
chestra and Chorus of La Sca
Opera House, Milan, conduct
by Victor de Sabata. Colun
bia 33CX1094-95.**

The principals and orche

Maria Meneghini Callas.

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ed for this recording are much the me as those used for Norma.

ut if the latter was somewhat ewarding as a performance, this ca more than makes up for it. osca is a grim tale, the action rude and harsh, the music and action go hand in hand in build- dramatic impact.

has none of the romantic aura ch lies on even the most emo- al scenes of Norma.

hese two placed side by side vide an eloquent contrast in ar- c outlook and operatic move- nt over a period of nearly 100 rs.

he general level of performance lity is set immediately the or- stra bursts into the savage chords n which the opera opens. The eness of atmosphere is felt ughout the byplay of the early nes, and even the romantic epi- e of Tosca's entrance does not rely win us from anticipating entrance of the villainous Scar- i

ortunately this occurs before the of the first side, so that the impact of his appearance is with such force as to send vers down the spine of the most se listener.

very villain in the piece can be de a ridiculous figure by an actor hout the personality and voice carry conviction. Tito Gobbi er loses his grip for a moment. is hard, cruel, lecherous and der with a sure theatrical sense, ich builds a picture for us where re is no picture but the one nted by his vocal power.

ORTH AN OSCAR

Vere there Oscars for this kind thing, he would get one.

Mme. Callas is equally good as sca. The pitch of her part is newhat higher than required by rma, and there are very few of se unflattering notes which I liked in that recording. Instead, exploits her magnificent voice ere it sounds best.

Stefano does well in the tenor t. His voice tends to be rather allow at times. Dynamically, he ches its limit rather quickly.

Finally, the orchestra shares the nors with the singers in every y, complementing their every od, and showing a recorded ality which is never lacking either subtlety or in force.

The only other Tosca I have is earlier release by Westminster. is a very fine one, and it features particularly good tenor. But this w Columbia I rate in the top nk of operatic releases to date. is complete on two discs with glish and Italian libretto.

HUGO WOLF—Quartet in D minor; Italian Serenade in G major. Played by the New Music Quartet. Philips A01158L.

According to the jacket note, this a first recording of the Quartet. confess that in common with any others I didn't even know the mous song maker had written e. But this is it, a work com- enced when Wolf was eighteen d not published until after he was ead.

It is decidedly in the manner of eethoven whom Wolf admired, eply introspective and of appreci- le length. It is music which eds considerable acquaintance, for is obvious that Wolf worked long and hard over it. There is evidence that it was never far from his mind throughout his life.

It is played with great competence and intensity by a young and vital quartet which specialises in unfamiliar contemporary and unusual works.

The well-known Italian Serenade gives a pretty good idea of their form, and throws some light on the value of their performance in the quartet.

They make full play of the light and airy nature of the Serenade, striking a fast pace and without much softness or romantic grace which is often introduced with good effect.

If, therefore, the softer moments of the Quartet might have benefited from such treatment, its less flexible moments at least receive full justice, lightening acceleration, and at times a razor edge.

The strings are extremely well recorded, although they sometimes don't reach a high degree of balance between themselves, and the fine cellist tends to show up too strongly.

A most interesting disc which should not be overlooked. Dead quiet surface, good, forward strong tone, many moments of really lovely sound.

PORTRAIT OF THE WALTZ—Danse Macabre, Saint Saens; Valse Triste, Sibelius; German Dance, Mozart; Tanzwaler, Busoni; Mephisto Waltz, Liszt; Dance of the Sylphs, Berlioz; Waltz, Stravinsky; Fete Polonaise, Chabrier. Played by the Philharmonia Orchestra conducted by Igor Markevitch. Columbia 330CX1273.

This is a most unusual record, unusual because it hasn't even what you might expect from the title.

The waltzes considered here are not for dancing, and there isn't even a single representative of Strauss. Markevitch, who has explained himself in the jacket note, has tried to do homage to an exquisite musical form and to search out its subtle and distinctive nature.

It is not easy to define just why a waltz is a waltz—just what it is that gives common ground to the eerie Danse Macabre, the dynamic and tremendous Mephisto, and the mad little waltz by Stravinsky.

That was one reason I found this quite a fascinating disc. The other was the excellence of the presentation.

Lack of a really wicked edge in such things as the Danse Macabre is about the only shortcoming which occurred to me—in general it is big and beautiful Philharmonia sound with a cleaner and more hi-fi sounding top register.

With most people I look a bit askance at a disc which features many bits and pieces. But this one is different, and the difference is that haunting something that makes a waltz, anywhere in the world. It sounds very much like an RIAA disc. The surface is good.

CHOPIN—Mazurkas Nos. 32, 20, 7, 15, 27, 41 and 17. Polonaises Nos. 5, 2 and 6. Played by Malcuzynski, Columbia 330CX1138.

There is very nice, clean piano tone on this record. The pianist makes the most of it with outlines

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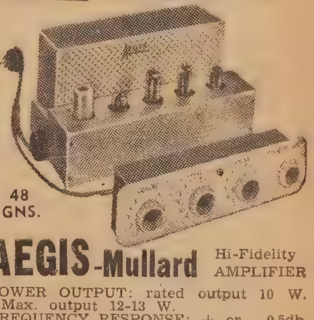

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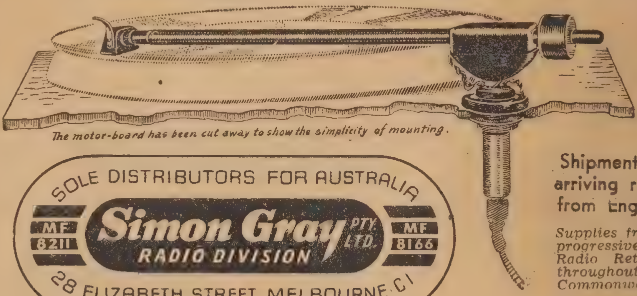

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It is, I suppose, permissible to nterpret" Chopin in a way which ould not be acceptable with many composers. Malcuzynski has own particular line, the most ticeable feature of which is the of holding a note or a chord ust a second longer than de- led by stricter tempo. He does ry well, but rather too often.

Secondly, I thought his approach agely lacking in fire for a Pole. embering past records he has e, I expected much more dash d less poetry.

s emphasis is on phrasing r than dynamics. Even in the naises, there are few of the fire- ns you would expect.

e net effect is one of pre-occu- n with the notes at the expense ll virility.

ese remarks indicate a some- personal reaction. I don't mean this is a poor record—on the rary, I have heard plenty which far less rewarding. But there some others who play Chopin the way I like to hear it.

he surface has a slight rustle, ble on the EMI position, and e is some additional noise near end of the Mazurkas.

NEAPOLITAN SONGS—Sung Giuseppe di Stefano. HMV BLP1052.

is claimed that Stefano is an exponent of Neapolitan songs, judging by this record I have doubts.

is true that he has a beauti- and striking voice, and he has eared in a number of recent atic releases with excellent re- s.

ut to sing songs such as O Sole and the rest, one needs among r things that undisguised heart- k which is so beloved by the an. It must be done naturally easily or it sounds not con- ing but hollow, not to say ridi- us.

efano hasn't got that traditional it of the warbles, and his substi- doesn't convince me. Either never did have just the right h, or it has been trained out of . I don't think he ever had it.

he accompaniments, too, should unashamedly simple and sacchar- n with songs like these. Too often have been worked up with a e modern-sounding licks which to n ageing sentiment didn't ring y.

he recording otherwise is good, much of it sounds fine.

MOZART—Quartet No. 20 in major (K499); Quartet No. 21 D major (K575). Played by he Roth String Quartet. Mer- ury MG10133.

No. 21 is the first of the "King Prussia" quartets commissioned Friedrich Wilhelm II of Prussia 1789. There were to have been quartets, but Mozart died after ree only had been completed.

he Prussian king like the uncle succeeded, was very fond of music, and was a cellist of some note. The three quartets he re- ceived, therefore, were written with special emphasis on the cello part, and on this record we hear Janos Starker as the cellist in the quartet. t is one of the loveliest compositions of all Mozart's chamber music. Every movement brings its own fresh and equally welcome mood—music which you can play endlessly with full enjoyment.

No. 20 comes between Nos. 14-19 dedicated to Haydn, and Nos. 21-23, the Prussian quartets. It was dedicated to a publisher friend called Hoffmeister. As the jacket note points out, Hoffmeister had been urging Mozart to write in a more popular vein. This apparently meant in an unruffled uncomplicated manner which the average man of the day could use for background music. At any rate, it does give that impression when compared with many of the quartets which surround it.

The Roth quartet plays them both with mastery and ease. The recording is on the sharp side, and the performance, too, could be assessed as a little matter-of-fact.

The only comparison I have is with the Netherland Quartet playing No. 29, which they do with rather more smoothness and urbanity. The Philips surface is quieter than Mercury's, although the latter is by no means bad. There are a few clicks in No. 20, but No. 21 is really quite good.

Frankly I liked the record, and have probably played it more often than any of the month's releases. I can't imagine anyone not hearing it with pleasure.

The Roth must by now have completed all the quartets from No. 14 to 23.

BRAHMS—Symphony No. 2 in D major opus 73—Variations on a Theme by Haydn, Opus 56a. Played by the Philharmonic Symphony Orchestra of New York. AO1163L.

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recording of the Haydn-Bra variations.

All the other recordings of symphony I have occupy both s of a 12in disc.

The space economy is the re of extremely careful microgra which has been carried out no deterioration in quality tha can hear.

In fact, clarity and wide dyna range are special features.

Bruno Walter has produced dynamic, highly colored versior the symphony which most pe will go for, and I don't know I won't be one of the persua ones.

A comparison with my favo until-now, van Beinum and Concertgebouw Orchestra, also Philips shows how much Wa has "laid it on" as against prob the most correct version of t all.

He has built up the peaks, tur the warm phrases, and vitalised tempos, not with vulgarity, but thoughtful intention. The sec movement is perhaps the best ample of the treatment, and colossal drive and acceleration builds into the last movement sh his urgent outlook most clearly.

FINE DISC

Technically it is probably best orchestral disc I have heard an American origin, and is in front rank of those made anywh The orchestra holds together at volume, its full tone and rich is not achieved by undue prom ence of instruments, and yet at times it sounds a big orches The best I can say is that I ped listening in a critical sense just enjoyed what I heard.

In this respect it is better t van Beinum's record. A Decca, Karl Schuricht, has some lo playing from the Vienna Philh monic, but begins to sound a old, while the Toscanini vers can no longer be considered technical grounds, despite its m virtues.

The new surface is the best the four mentioned, although Beinum's is close behind, as it on total points scored. In fact Walter's coloring annoys you, it still be the version to have. this new disc is awfully hard resist.

The Haydn variations are quite on the same level of all ro excellence, but they are still g and worth having. Altogether a to be reckoned with.

BRAHMS — Concerto fo Piano and Orchestra No 1 in minor Opus 15, played b Friedrich Wueher and th Vienna Philharmonic Orches tra conducted by Hans Swarow sky Vox APL8000

My first impression of the as the first bars burst forth one of dismay. What was wro A heavy, floppy, lumpy hot potch of instruments growled worried away at the music in most unattractive way

Aha, I said, I'll bet it does sound that way on my Backh recording (which I hadn't pla for some time). That's what thought, until I played it!

The truth is that this opening s tion is devilishly hard to reco The Backhaus record is a bit b ter because it isn't so forwa

the sound has more room to
:ogether with itself.

ie same thing, naturally, occurs
a concert hall, where even
reverberation is available.

it to run it off in a fairly dead
.o with close microphones, sets
exceedingly tricky problem in
nce.

some extent similar difficul-
are met with throughout the
re work. That little stab of
s behind the first piano en-
e, how carefully that must be
aged. The middle movement is
y easy, but there are a few
ner tricky bits in the finale.

got the impression that the
.e thing isn't quite smooth — it
hasn't ironed out as it should.
it, possibly, Brahms wasn't
king of recording engineers
n he wrote it!

I'll say that these perspiring
s would do well to work out
e special technique to tame
titanic and so far untamed
erto.

ie pianist is a true Brahms
er of the old school. He takes
ll seriously and a bit ponder-
y, but plenty of it is very good
piano-to-orchestra balance is
it right, but the piano sounds
er as if it isn't in the same
e. It may be a trick of mike
tioning.

n the whole I think I'd pick
haus as a performer, but the
ral recording standard on this
is brighter and more immedi-
It has much merit and I think
leave the choice to you.

quiet surface adds to its good
its.

**JOSE GRECO BALLET—El
aile de Luis Alonso, Mosaico
villano, Danza Del Contra-
ndista, Madrid 1890. With the
rquesta Zarzuela de Madrid.
stival CFR10-762.**

record the sounds of a man
orming a very noisy dance to
accompaniment of an orchestra
seem at first glance to be rather
nseless procedure, and so it is
ss you have a feeling for the
ic and the rhythm.

iat many people have is borne
by the number who buy records
this one, in which Jose Greco,
ibly the most famous Spanish
er alive today, records his flying
steps in three short and one
er ballets.

reco tours the world with his
Spanish ballet company, which
assisted him here. The record-
was made in Spain by the Am-
ian Decca Co., although the disc
cut in Australia.

his record is quite different from
vious releases more intent on
rding a large amount of footwork
in supplying music. Here the
ic is a major contribution, par-
larly in Madrid 1890, where
osphere is given by voices, effects
noises off.

pecial mention for the castanet
ers, whose efforts are vividly re-
led.

n fact, this goes for the whole
luction. I found it sounded best
n tamed down with the EMI set-
. If you have an RIAA that
ht be best of all.

he sound is extremely forward
n cymbals and triangles to
le your tweeters. In Madrid
the voices are rather two for-
d for best effect, and seem a bit peaky on sibilants. Surface noise is quite low.

To sum up—nothing quite like it.

BEETHOVEN—Symphony No. 7 in A major, Opus 92. Played by the New York Philharmonic Orchestra conducted by Bruno Walter. Columbia 330CX1120.

The introductory section of the Seventh's first movement is sufficient to place it chronologically without much effort on the listener's part.

One hears quite clearly the references to the mood and themes of the Pastoral symphony which preceded it, and the tones of the Ninth symphony, which must have been growing already in Beethoven's mind.

In fact, the whole of the first movement is so tinged with the shadow of the Ninth that one wonders whether some of the sketches for it were not common to both works.

The second movement is strongly reminiscent of the Funeral March from the Eroica, even with its Allegretto marking, and Walter's strict observance of it.

Despite the fine Presto and the rollicking last movement, to me it is the least rewarding of the Beethoven symphonies.

Walter's approach is one of vigor and bustle right from the start.

Undoubtedly he is aware of the very strong rhythmic base on which the music stands, for he has defined it clearly throughout, and sought for his interest by contrast in dynamics and in tempo.

MAY BE QUERIED

I am sure some of these changes in pace—and make no mistake we are intended to be aware of them—will not be appreciated by the more conservative Beethoven minds. Nor will everybody accept the bunrush in the last movement, where Walter builds the long coda into a whirlwind finish.

On the other hand this is a most interesting reading—its vigor does not mean that Walter has been careless. His ideas are easy to follow and the orchestra carries them out smoothly and surely.

The recording could have been made with more reverberation. Frequently it lacks "air"—none of the symphonies take too kindly to deadish studios and close technique. At times the woodwind and horns grunt away with a prominence which may not have been intended. When there is high pressure, particularly in the last movement, the sound becomes confused.

But this is probably as good a Seventh as there is, although I have not compared it with one by Karajan which is admired by many.

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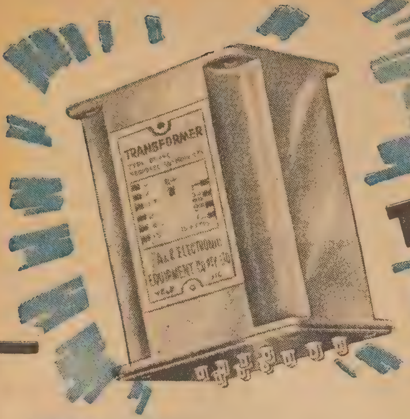

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OUTPUT TYPE

TYPE 763 — 15 watts.
Prim.: 5000, 3000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

TYPE 920 — 15 watts.
Prim.: 5000, 3000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

TYPE 897 — 15 watts.
Prim.: 10,000, 8000 ohms P.P.
Sec.: 500, 250, 166, 125 and 100 ohms.

TYPE 896 — 15 watts. Prim.: 10,000, 8000 ohms P.P.
Sec.: 15, 12.5, 8, 3.7 and 2 ohms.

SPECIAL HI-FIDELITY
+ − 1 db 20-40,000 cps

OUTPUT TYPE

TYPE 870 — 6 watts.
Prim.: 10,000 ohms P.P.
Sec.: 2 or 8 ohms.
(for "Rola" 120X)

TYPE 871 — 12 watts.
Prim.: 10,000 ohms P.P.
Sec.: 2 or 8 ohms.

TYPE 872 — 12 watts.
Prim.: 10,000 ohms P.P.
Sec.: 3.7 or 15 ohms.

FOR MULLARD "5-10" AMPLIFIER

TYPE 2505 — 12 watts.
Prim.: 6000 ohms C.T.
Sec.: As below.
Resp.: 10-50,000 cps.
Type 2505-8 for 2 or 8 ohms Sec.
Type 2505-15 for 3.7 or 15 ohms Sec.

ULTRA LINEAR OUTPUT

TYPE 931-15: 20 watts.
Prim.: 4500 ohms P.P.
Sec.: 3.7 or 15 ohms.
Resp.: 10,-60,000 cps.
Valve: EL37, KT66. 6L6,etc.
19% Screen Taps.

TYPE 931-8: 20 watts.
Prim.: as 931-15.
Sec.: 2 or 8 ohms.
Resp.: As 931-15.
Valves: As 931-15.
19% Screen Taps.

TYPE 921-15: 20 watts.
Prim.: 6600 ohms P.P
Sec.: 3.7, or 15 ohms.
Resp.: 10-60,000 cps.
Valves: 807, KT66, etc.
19% Screen Taps.

TYPE 921-8: 20 watts.
Prim.: As for 921-15.
Sec.: 2 or 8 ohms.
Resp.: As 921-15.
Valves: As for 921-15.
19% Screen Taps.

TYPE 916-15: 12 watts.
Prim.: 8500 ohms P.P.
Sec.: 3.7 or 15 ohms.
Resp.:10-50,000 cps.
Valves: 6BW6, 6V6, KT61, etc.
19% Screen Taps.

TYPE 916-8: 12 watts.
Prim.: As 916-15. Sec.: 2 or 8 ohms. Resp.: As 916-15
Valves: As 916-15.
19% Screen Taps.

TYPE 949: 12 watts.
Prim.: 8000 ohms P.P. Sec.: 2, 8, 12.5 and 15 ohms. Resp.: 10-50,000 cps. Valves: 6V6, 6BW6, KT61, EL84, etc
19% Screen Taps

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THE SERVICEMAN WHO TELLS

(Continued from page 59)

almost dramatic. The violent ation ceased and, even before d a chance to align the RF , there was ample evidence that et was starting to "come good" tivity was much nearer normal several country stations could eard.

t there were still some leads h needed tidying up. The main was that from the AVC diode e 1 and 2 meg. AVC resistors. oint which many home con-tors seeme unable to appreciate at one end of these resistors ot" and the other end "cold". ference to the circuit and a thought should make this clear. end of each resistor is connected e diode (pin 1) and to the top e second IF transformer pri-. At this point in the circuit o be found the strongest IF l of any part of the channel. ther words, it is really "hot".

FROM I.F.

e other end of the 2 meg. re-r is effectively bypassed to sis; in this case by the .05 mfd enser from the lower end of first IF transformer secondary. fairly obvious, therefore, that end and all the leads connected , will be quite free from IF ls and can be wired in any enient manner.

milarly the 1 meg. resistor is ed through the back bias net-and is also quite free of un-ted signals at this end.

l of which simply adds up to fact that it is essential to keep "hot" end of these resistors ose to the diode pin or IF trans-er pin as possible. Provided this aution is observed you can do t you like with the other ends.

ill keen to see how far I could I tried aligning the RF stage re touching these leads. The lt was exactly as I should have cted; the set spilled over before uld reach a peak setting.

y the time I had reduced the th of the offending lead from t four inches to nearer half an and tidied up a few other doubt-leads, the set was much more le. I was able to peak all ad-ments and carry out the align-t without further trouble. By time I had finished it was put-up a really fine performance; r cry from the squealing, splut-g thing that had landed on my ch some time before.

IO TO BLAME?

umming up, one may reasonably whose fault it was that the set in such a bad way. Well, I 't know who was responsible for bent slug but whoever it was must also take the blame for broken IF lead. The unsoldered l can only be the maker's respon-lity and is a particularly bad e of fault.

he padder in place of the trim-was probably the fault of the ply house who marketed the kit, he makers of the trimmers, either which could have mixed their ks. While an easy enough thing to happen it can cause a lot of strife.

As for the builder; well, I'm afraid he wouldn't have scored many marks for his interpretation of the original plans. While I don't like "knocking" a beginner's effort—after all we all have to learn—I do feel that many could do a lot better if they exercised a little more care

A thorough and detailed study of the original article is the first requirement for any home constructor. If, after reading it, he is not perfectly clear what it is all about and exactly how the job is to be done, then it is fairly obvious that the article was intended for someone with more experience.

On the other hand, when a project is finally selected every effort should be made to follow the original plans. There is little to be gained by trying alternative layouts "just for the fun of it", and much to be lost. Few beginners can hope to design their own layout with any suggestion of logic. Why not accept the original designer's ideas?

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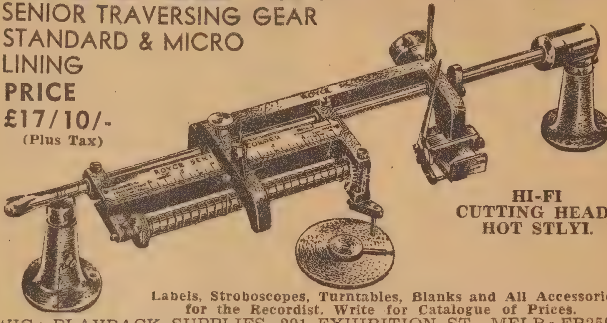

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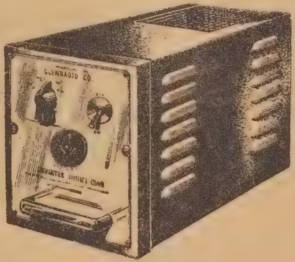

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A READER BUILT IT!

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AMATEUR FREQUENCY METER USES ONLY THREE VALVE

PMG regulations require that all Amateur Stations have a heterodyne frequency meter on hand, capable of measuring accurately their frequency of transmission. The instrument described herewith is used by Mr. Tim Hunt, VK3AZY, of "Yamala", Olivers Hill, Frankston, Victoria.

MR. HUNT says that the unit has been in use during the past two months and has proved to be completely reliable. Even the little crystal insert, which has been pressed into service as a miniature speaker, has shown no signs of distress.

The instrument is very stable and, after an initial warm-up period of about half an hour, will zero beat the crystal calibrating circuit indefinitely.

The crystal calibrator operates on a fundamental frequency of 3.5 Mc, using a 6C4 in a Pierce oscillator circuit. Output is available naturally on harmonics of this frequency.

The variable oscillator uses a 6AU6 in a conventional electron-coupled circuit.

Coil L1 comprises 25 turns on a half-inch former, wound with 22 gauge enamelled wire and tapped eight turns from the earthed end.

It is tuned by a number of parallel capacitors, which provide a high-C circuit, adequate bandspread and provision for zero setting.

The entire variable oscillator assembly is built on a tray supported from the front panel by the tuning capacitor mounts. Purpose of this is to minimise any stresses on the variable oscillator assembly.

Output from both oscillators is fed to the grid by one half a 6SN7-GT, operating as a detector. This same grid connects also to a tip-jack, allowing it to be fed with RF from the transmitter.

Output from the detector is amplified by the second half of the 6SN7-GT and made audible in a crystal microphone unit, which serves in this application as a miniature speaker.

For a calibration check the variable oscillator can be beat against the crystal, a heterodyne being evident in the "speaker".

The VFO (or transmitter) can also be heterodyned against the crystal, although normal procedure would be to beat it against the variable oscillator at frequencies within the allotted band.

The entire unit operates from a modest 150-volt HT supply.

The frequency meter constructed by Mr. Hunt used the valve types shown by the circuit but most amateurs will have odd valves gleaned from military disposals sources, &c., they would like to use.

We can't list all the possibilities but for the 6SN7 you could substitute the 6SL7-GT, 12AH7-GT or in the modern 9-pin miniature series the 12AU7, 12AT7 or 12AX7 could all be used with relatively minor differences in performance.

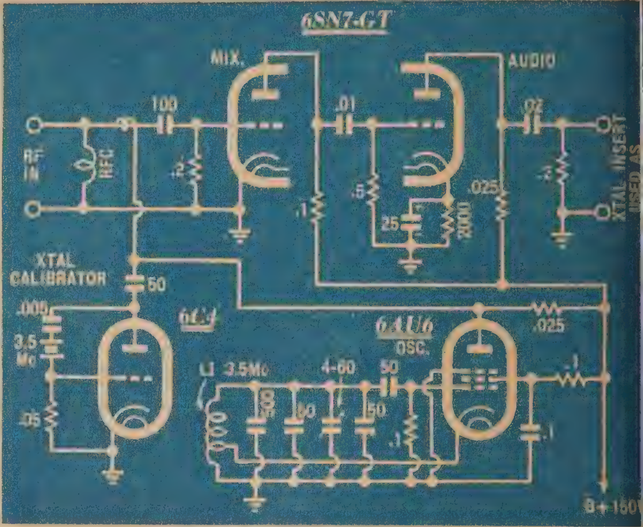
Many amateurs have stocks of the VHF triode type 7193. Two of these could be used to replace the 6SN7 and a third to replace the 6C4 crystal oscillator.

The electron coupled oscillator requires a pentode valve since the screening effects of the screen grid (grid No. 2) and the suppressor grid provide the desired isolation between the output and the oscillat circuits.

Suitable types are the octal ba 6SH7, 6SJ7, and 6SK7. The dou ended types 6J7-G, 6U7-G a similar are also suitable. High valves, the most notable of wh are the 6AC7 and the EF50, are so suitable because of the relativ large change in grid to cath capacitance during warm up.

If your particular location is su ject to wide changes in supply vo ages a gaseous voltage regula tube would be a worthwhile ad tion. These are available with working potential of 150V and o the two oscillator stages need controlled.

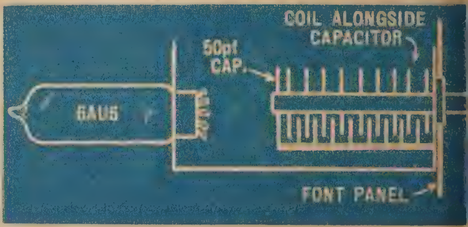
(Editor's Note: A detailed descr tion of a Frequency Meter, conta ing much useful information on subject, appeared in the Augu 1949, issue.)



☆

The circuit of Mr. Hunt's frequency meter and (right) his method of supporting the variable oscillator sub-chassis.

☆



THE HAM BANDS WITH BILL MOORE

The country from which any amateur radio station operates is identified by means of the prefix letters or numbers used in the first portion of the call-sign. The improvement in propagation conditions should provide listeners with an opportunity to hear signals using some of the rarer prefixes.

E following list covers prefixes used y amateur stations in the countries n. In some cases a number of pre- cover the same general area such ntarctica, where a number of stations ate from different nation's bases. In cases they count as different tries.

3—Sikkim, AC4—Tibet, AC5— an, AP—Pakistan.

—Formosa (also C3).

-China, C3—Formosa (also BV), C9— churia, CE7Z—Antarctica (also LU-Z, KC4, VP8,), CEO—Easter Island, O—Cuba, CN2, KT1—Tangier Zone, —French Morocco, CP—Bolivia, CR4 pe Verde Is., CR5—Port. Guinea, CR5 incipe, Sao Thome, CR6—Angola, CR7 zambique CR8—Goa Port. India), ugal, CT2—Azores Is., CT3— —Macau, CR10—Port. Timor, CT1— eira Is., CX—Uraguay.

, DL, DM—Germany, DU— Philip- Is.

—Spain, EA6—Balearic Is., EA8— ry Islands, EA9—Ifni, EA9—Rio de EA9—Span. Morocco, EAO—Span. ea, EI—Eire, EL—Liberia, EQ—Iran, —Eritrea, ET5—Ethiopia.

-France, FA—Algeria, FB8—Amster- and St. Paul Is., FB8—Kerguelen Is., —Madagascar, FC—Corsica, FD—Fr. land, FE8—Fr. Camerons, FF8—Fr. t Africa, FG—Guadeloupe, F18—Fr. China, FK8—New Caledonia, FL8— Somaliland, FM Martinique, FO8— perton Is., FO8—Fr. Oceania, FP8— Pierre and Miquelon Is., FQ8—Fr. atorial Africa, FR7—Reunion Is., FT4 nisia, FU8, YJ—New Hebrides. FW8 allis & Futuna Is. ,FY7—Fr. Guiana Inini

-England, GC—Channel Is., GD -Isle Man, GI—Northern Ireland, GM—Scot- l. GW—Wales.

A—Hungary, HB1-9—Switzerland. HC uador, HC8—Galapagos Is. , HE— henstein, HH—Haiti, HI—Dominican ublic, HK—Colombia, HKO—Archi- go of San Andres and Providencia, —Korea, HP—Panama, HR—Honduras, —Siam, HV—Vatican City, HZ—Saudi bia.

—Italy, I1—Trieste, I5, MS4—Italian naliland, IS1—Sardinia.

A—Japan (also KA), JY—Jordon (also). JZO—Netherlands New Guinea.

& W—USA, KA—Japan, (also JA), O—Bonin and Volcano Is., KB6— ker, Howland and American Phoenix KC4—Navassa Is., KC4USN—Z—US ions in Antarctica, KC6—East Caroline KC6—West Caroline Is., KG4—Guan- amo Bay, KG6—Mariana Is., KH6— waiian Is., KJ6—Johnston Is., KL7— ska, KM6—Midway Is., KP4—Puerto o, KP6—Palmyra Group, Jarvis Is., 6—Ryukyu Is., KS4—Swan Is., KS6— erican Samoa, KTI—Tangier Zone so CN2), KV4—Virgin Is., KW6—Wake KX6—Marshall Is., KZ5—Canal Zone.

5—Canal Zone.

A, LB—Jan Mayen,(LA, LB—Norway, . LB—Svalbard, LU—Argentina, LU.Z ntarctica (also CE7Z, VKI, VP8, KC4), —Luxembourg, LZ—Bulgaria.

1—San Marino, MB9—Austria (also), MP4—Bahrein Is., MP4—Kuwait, 4—Qata, MP4—Trucial Oman, MS4— lian Somaliland (also I5).

A—Peru, OD5—Lebanon, OE—Austria so MB9), OH—Finland, OK—Czecho- vakia, ON4—Belgium, OQ—Belgian ngo, OX—Greenland, OY—Faeroes, —Denmark.

PAO—Netherlands, PJ2—Neth West lies. PK1, 2, 3—Java, PK4—Sumatra, 5—Nth. Borneo, PK6—Celebes and lucca Is., PX—Andora, PY—Brazil, I—Neth. Guiana.

SM—Sweden, SP—Poland, ST—Anglo- yptian Sudan, SU—Egypt, SV—Greece, —Crete SV—Dodecanese.

TA—Turkey, TF—Iceland, TG—Guatemala, TI—Costa Rica. TI9—Cocos Island (Pacific).

XE—Mexico, XZ—Burma.

YA—Afghanistan, YJ—New Hebrides (also FU8), YK—Syria, YN—Nicaragua, YO—Rumania, YS—Salvador, YU—Yugoslavia, YV—Venezuela, ZA—Albania, ZB1—Malta, ZB2—Gibraltar, ZC2—Cocos Is. (Indian Ocean, also VKI), ZC3—Christmas Is. (Indian Ocean), ZC4—Cyprus, ZC5—Brit. North Borneo, XC6—Palestine, ZC7—Jordan (also JY), ZDI—Sierra Leone, ZD2—Nigeria, ZD3—Gambia, ZD4—Gold Coast, Brit. Togoland, ZD6—Nyasaland, ZD7—St. Helena, ZD8—Ascension Is., ZD9—Tristan da Cunha and Gough Is., ZE—Southern Rhodesia, ZK1—Cook Is., ZK2—Niue, ZL—New Zealand, ZM6—Brit. Samoa ZM7—Tokelau (Union Is.), ZP—Paraguay, ZS1, 2, 4, 5, 6—Union of South Africa, ZS2—Marion Is., ZS3—Sth. West Africa, ZS7—Swaziland, ZS8—Basutoland, ZS9—Bechuanaland, 3A—Monaco, 3V8—Tunisia, 4S7—Ceylon, 4W1—Yemen, 4X4—Israel, 5A—Libya, 9S4—Saar.

Countries without current prefixes, Aldabra Is., Comoro Is., Fridtjof Nansen Land, Kermadec Is., Mongolia, Nepal, Wrangel Is.

Currently XW8 is being used by Laos, and 3W8 Vietnam and both are likely to be declared new countries together, with Cambodia.

In the case of LU-Z stations, their location can be identified by the final letter of their call. Calls ending in A, G, M are in the South Orkneys, C, I, O in the South Shetlands and B, D, E, F, H, J, K, L, M, N, P, Q, R, and W are in Antarctic. LU7ZB for instance would be located in Antarctic.

UA1, 2, 3, 4, 6—European R.S.F.S.R., UA9, 0—Asiatic R.S.F.S.R., UB5—Ukraine, UC2—White Russia S.S.R., UD6—Azerbaijan, UF6—Georgia, UG6—Armenia, UH6—Turkoman, U18—Uzbek, UJ8—Tadzhik, UL7—Kazakh, UM8—Kirghiz, UNI—Karelo-Finnish Republic, UO5—Moldavia, UP2—Lithuania, UQ2—Latvia, UR2—Estonia.

VE, VO—Canada, VK—Australia, VKI—Antarctica (also LU-Z, CE7Z, KC4, VP8), VKI—Heard Is., VKI—Macquarie Is., VKI—Cocos Is., (Indian Ocean also ZC2), VK9—Norfolk Is., VK9—Papua, VK9—Territory of New Guinea, VO, VE—Canada, VPI—Brit. Honduras, VP2—Leeward Is., VP2—Windward Is., VP3—Brit. Guiana ,VP4—Trinidad & Tobago, VP5—Turks and Caicos Is., VP6—Barbados, VP7—Bahama Is., VP8—Antarctica (also LU-Z, VKI, KC4, & CE7Z), VP8—Falkland Is., VP8—South Georgia, VP8—South Orkney Is. (also LU-Z), VP8—South Sandwich Is., VP8—South Shetland Is. (also LU-Z), VP9—Bermuda, VQI—Zanzibar, VQ2—Northern Rhodesia, VQ3—Tanganyika, VQ4—Kenya, VQ5—Uganda, VQ6—Brit. Somaliland, VQ8—Chagos Arch., VQ8 Mauritius, VQ9—Seychelles, VRI—Gilbert and Ellice Is., Ocean Is., VR2—Fiji, VR3—Fanning Is. group, VR4—Solomon Is., VR5—Tonga (Friendly Islands), VR6—Pitcairn Is., VS1—Singapore, VS2—Malaya, VS4—Sarawak, VS5—Brunei, VS6—Hongkong, VS9—Aden and Socorra, VS9—Maldive Is., VS9—Sultanate of Oman, VU2—India, VU4—Laccadive Is., VU5—Andaman & Nicobar Is.

BIG ATTENDANCE AT NSW FIELD DAY

OVER 100 members and visitors attended the NSW Divisional Hamfest nor 1956 held over the Australia Day weekend in late January.

Three main sessions were conducted. The first opened at Science House, Sydney, with the January monthly meeting. The lecturer was Charlie Higgins, VK2ALO, radio engineer, active amateur and ex-secretary of the division. His subject covered portion of the radio work of the CSIRO especially with reference to the radio astronomy station at Pott's Hill, Sydney. Mention was even made of the reception of radiation from the planet Jupiter on 20 metres.

The Saturday afternoon and evening sessions were held at the Ocean View Cabaret at Brighton-le-Sands. Lectures during the afternoon were delivered by Harry Solomons, VK2AJZ, on Modulation, Vic Cole, VK2VL, on 144 Mc Walkie-Talkie equipment, Han Ruckert, VK2AOU, on the tuning of parasitic arrays on the ground and Stan Bourke, VK2EL, on a digital indexing system for QSL cards.

Later the HF BCI/TVI committee presented a demonstration of the Harmonics generated by the AOCP class transmitter and their cure.

The president of the committee, Harry Oakes, VK2FA, assisted by VK2GE, 2AOU, 2AJW and Norm Burton presented the demonstration.

The hamfest was officially opened by the president Jim Corbin, VK2YC, during the evening session and delegates from country zones responded. They included Ben Ash, VK2ABT, North West Zone, Norm Seymour, VK2XZ, Western Zone, Zone officer Jim Edge, VK2AJO, South Western Zone, and Zone officer Noel Hansen, VK2AHH, North Coast Zone.

ZL1AH, who attended was asked by the president to convey greetings to New Zealand amateurs, and to inform the NZART that the division greatly appreciated the work performed by the official guard stations during 3.5 Mc emergency net operation.

Sunday morning was spent on a frank discussion between council members and country amateurs (from 15 different towns) on WIA organisation and its problems.

FLOOD ACTIVITY

DURING mid-January, radio amateurs in Southern Queensland were active during the serious flooding of the Macintyre River and it's tributaries. Heavy damage to towns along the river was recorded during the floods.

Although in most cases telegraphic communication was not interrupted, amateurs were to afford emergency contact in a number of cases.

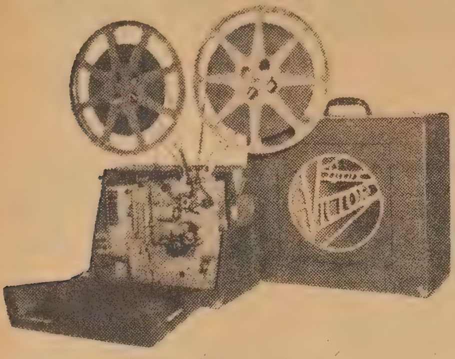
Leo Stratford, VK4LS, of Goondiwindi was in the centre of the worst affected area and operated for a number of days handling important traffic.

He acted as control officer, of a net that quickly formed on 7 Mc to handle traffic when required. Many amateurs in Queensland and northern NSW co-operated to ensure full coverage of the areas affected by flood.

THE BERU CONTEST

THE 1956 BERU contest was well supported although the HF band did not provide the DX signals of the Oct. and Nov. 1955 period. The better band was again 14Mc but the 21Mc band provided some excellent contacts. Although the telephony and listener's sections of the contest were deleted some years ago, the

AT LAST . . ! a few more availabl



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section was reintroduced for this the 19th annual contest. No particu- high QSQ tallies were noted in VK9XK however should register a score.

AQ some three hours before the letion of contest had recorded over ontacts, and should be difficult to ace from first position.

OVICE OVERSEAS

EST information on Novice tations operating in the US and Ter- es is as follows. On the HF bands are permitted to transmit on 3700 50 Kc/s, 7150 to 7200 Kc/s and 21,100 250 Kc/s. The input is restricted to atts on C W only.

tions in US use the WN or KN pre- while overseas in the territories, drop the initial letter in the prefix substitute W. A KZ5 novice in the Zone would use the prefix WZ5, one located in Hawaii WH6 in place H6. Quite a number of them can be icted on 21Mc CW.

orth Coast Convention

UNGA, some 300 miles north of ydney, is the venue of the NSW h Coast's Zone Convention held an- y.

ter is early this year and the event take place on 30th and 31st of h and April 1st.

Good Friday evening, March 29th, to the official opening of the con- ion a general discussion on WIA technical subjects will be conducted.

e usual full programme of field ating contests will be run including Terry Memorial contest, the 144 Mc/s en transmitter search, and the unga Scramble". The usual Sunday ing concert will provide entertain- t for all attending and a fishing con- conducted.

commodation at guest houses or the l is available. Zone officer Noel sen, VK2AHH, should be contacted is home or on the air if such ac- modation is required.

ny of the North Coast gang will ly further information, programs are lable and VK2WI will provide the st news in the weekly broadcasts.

VHF WORK

AIN current activity among the NSW VAF group is the building of crystal trolled 144 Mc/s transceivers in prep- tion for future activity with the Spel- ogical Society and Bush Walkers Club.

he first event is scheduled to take e in late February when a weekend be spent at the Jenolan Caves with mbers of the society. Further experi- nts will be carried out on 144 Mc/s ing cave exploration.

he next operation with the Bush lkers Club, is set down for April 14th 15th, when a 144 Mc/s base station be located at Kurrajong in the Blue untains. It will contact radio amateurs ompanying bush walking parties dur- a simulated search.

hese amateurs will carry 144 Mc/s kie-talkie equipment and hope to nonstrate the value of really portable in search for missing persons in the h.

he section's autumn field day is to e place on March 18th and stations l again be operating in the field on Mc/s in many parts of NSW. New ations not previously used are planned all stations leaving Sydney, and it anticipated that signals will be pre- ted over VK2WI, HF and VHF, Sun- broadcasts.

he January hidden transmitter search the NSW VHF section was again won Bob Winch, VK2OA. Bob, who ar- ed in 40 minutes is now the leading ex- nent in this field and has been first a number of these events.

A surprise scramble conducted im- diately after the VHF section's Sun- broadcast was won by Ted Howard, 2XX. Twenty stations participated in 144 Mc event.

Visitors to Sydney in late January re Geoff Partridge, VK2VU, of Single- , and Ken Mitchelhill, VK2ANU, of swellbrook, country VHF enthusiasts. ey attended the hamfest and then pected the Sydney VHF shacks.

ROSS HULL CONTEST

CONDITIONS experienced during January on 50 mc/s for the WIA's Ross Hull Memorial Trophy showed little improvement over those of December. However some reasonable scores were totalled, especially among the VK5's, who seemed to be more favorably placed for sporadic F openings compared with other states.

Outstanding feature was the reception of a number of VK4 stations on the band by VK115 on Macquarie Island, the distance 3000 miles.

Openings were poor by comparison with other years and the general lack of activity on the band reflected the absence of DX signals.

Latest "grapevine" information is to the effect that VK4NG had contacted either a JA or KA, but at the time of writing this fact has not been confirmed.

REGIONAL MEETING

SOME interesting recommendations were made as a result of the IARU Region I, VHF liaison officers' meeting, held in Brussels in late 1956. Representatives from Beguim, France, Germany, Great Britain, Holland, Yugoslavia and Switzerland attended.

Action is to be taken on the following points: — the organisation of al all-European VHF relay contest, the setting up of standard methods of confirming long distance records, the issuing of special VHG certificates, and the locating of VHF stations by means of latitude and longitude.

It is pleasing to note the close co-operation between national societies in Europe since the inception of the Region I, IARU organisation. It must assist amateurs generally in future efforts for further recognition at International Telecommunications Conferences and the like.

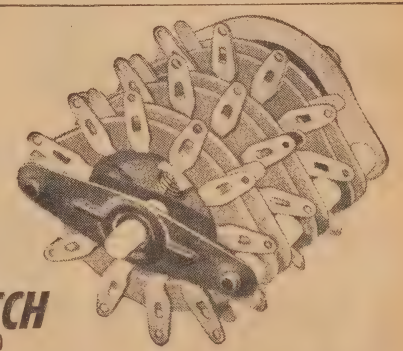
IN THE ANTARCTIC

THIS year more radio amateurs will join those operating from national bases in the Antarctic. The first of the American group should be operating this month.

Some 40 amateurs are listed among the members of the US Antarctic Expedition known as Task Force 43, Operation Deep-Freeze. Currently British, Chilean, Argentinean and Australian amateurs are all active from the south.

The call block KC4USA—Z has been allotted to members of the expedition. KC4USA at Kainan Bay in Little America and KC4USV at McMurdo Sound should be first on the air about late March.

KC4USB will transmit from an advance base in Marie Byrd land and KC4USN will be located right at the South Pole. It is anticipated that considerable delay will occur before confirming QSL cards are obtained from these stations. Cards for stations in the expedition should be addressed to Task Force 43, Room 831, Q'ld P.O. Building, 12th and Penna Ave., N.W., Washington, DC. These amateur stations will be very active relaying traffic back to the US and contacting DX stations throughout the world.



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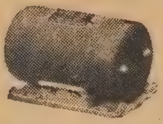

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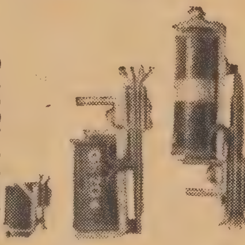

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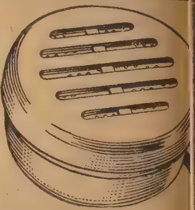

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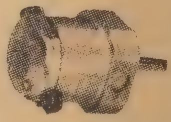

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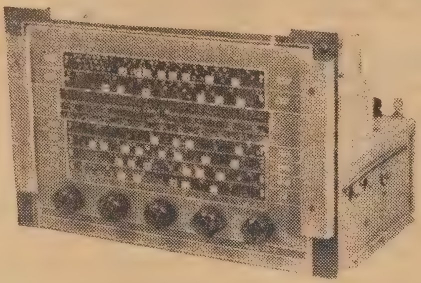

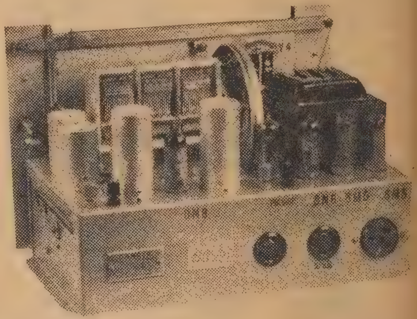

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CLASSIC RADIO

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Phone UA2145

re's Your Answer, Tom!

(Continued from page 73)

the case of an ordinary house, ially treated walls and ceilings ther with heavily draped win- s and carpeted floors will great- educe noise of middle and high uencies. Unfortunately lower uencies by rumbling trucks and aft engines will still worry you ss you can do something about ting the foundations. And that's y hard.

there you have it, Tom, if you to, you may have your whole e soundproofed, if you like to for it.

Do arc lamps, as used in eatre projectors, require AC or C for their operation?

ost big theatres use DC for arc lamps, Tom, for several good reasons. One of these is a DC arc is much more efficient its AC counterpart. Where a imum of light is required, as in screen projection for instance, is of prime importance.

lso with DC arcs it is possible to entrate the flame in a much ller area than with AC, more ely approaching the ideal point ce of light.

he DC is supplied to the arcs heavy duty rectifiers.

nother reason for using DC with is the fact that an AC arc pro- es a light level which varies with frequency of the supply voltage.

he usual mains frequency in Aus- ia is 50 cycles. On the other d, the frame repetition speed of nm film is 24 frames per second. ing the projection of each frame light is interrupted once, so that ally 48 separate images appear the screen.

he 48 images and the 50 c/s tuation of light combined can very annoying flicker at the of 2 c/s. It is therefore under- dable that AC arcs are not very ular for projection work.

A COURSE IN TELEVISION

(Continued from Page 93)

Even on the broadcast band, receiving aerials are likely to have some directive qualities, which means that they will pick up signals more effectively from one direction than from another. As a rule, however, the characteristics are so random and obscure that little account is taken of them.

Against this, the directive qualities of a resonant VHF aerial are quite marked—and predictable—and it is usual to face them so that their response lobe is toward the source of signal.

For this very reason, Amateur Station operators instal rotating aerial systems, so that both transmission and reception benefit by their directive qualities.

As shown in figure 50, the directive qualities of a horizontally mounted dipole aerial resemble a figure 8. Signals are heard to best advantage broadside to the aerial and poorly from the directions in which the elements are pointing.

Actually little difference would be apparent in the strength of signals up to 45 degrees off the broadside position but nearer than this to the axis of the elements would drop the signal strength considerably.

A so-called "beam" aerial results when other elements are mounted in proximity to a dipole to emphasise still further its directional properties.

A simple beam aerial can be arranged by erecting a horizontal dipole broadside to the desired signal source then mounting behind it a "reflector" element.

For receiving purposes, the reflector is normally mounted one quarter wave behind the dipole and made approximately 5 pc longer than it. In other words it will approximate in length an electrical half wave.

The diameter of the reflector is not important although, for the sake of convenience, it is usually cut from small diameter tubing and clamped at its centre to the supporting boom.

The effect of adding a reflector behind a dipole is illustrated by the broken line on the polar diagram. It is noteworthy that the pick-up or gain of the aerial is increased substantially in the forward direction while there is very little pick-up from the sides or the rear of the beam.

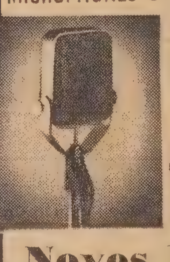
The beam effect may be increased still further, by adding a "director" element in front of the dipole. This is normally made about 4 pc shorter than the dipole but in other respects the same remarks apply as for the reflector.

The use of a three-element beam, as in figure 51, gives an increase in the incoming signal level of about five decibels while it discriminates against possible interference arriving from all but the forward direction.

To achieve additional "forward gain", it is possible to use a couple of directors or to "stack" beam arrays one above the other.

And here we must leave the matter for the time being. However, having viewed the fundamentals of VHF propagation, aerial systems and transmission lines, the reader will be in a better position to understand the problems of design and installation surrounding television aerials.

AWA
RONETTE
MICROPHONES & ACCESSORIES



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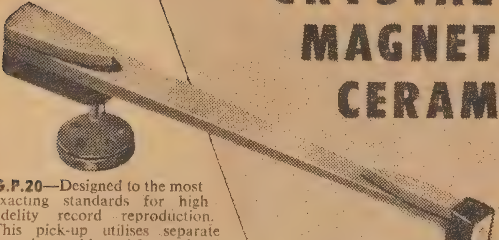

G.P.20—Designed to the most exacting standards for high fidelity record reproduction. This pick-up utilises separate interchangeable pick-up heads for standard and microgroove recordings. **PRICE, £7/19/6.**

H.G.P.40—A de luxe crystal pick-up to satisfy the most exacting. Complete with standard and microgroove heads. **PRICE, £9/15/-.**

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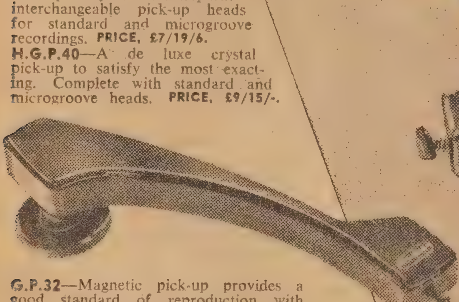
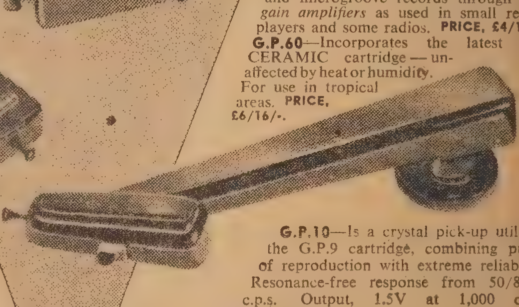


G.P.32—Magnetic pick-up provides a good standard of reproduction with normal equipment at reasonable price. Output voltage—½ volt at 1,000 c.p.s. **PRICE, £2/12/6.**



G.P.10—Is a crystal pick-up utilising the G.P.9 cartridge, combining purity of reproduction with extreme reliability. Resonance-free response from 50/8,000 c.p.s. Output, 1.5V at 1,000 c.p.s. **PRICE, £3/12/6.**

H.G.P.39 CARTRIDGE—Designed to meet the most exacting requirements of modern recordings—low element mass and very high compliance enables the heaviest modulation possible to be traced with a minimum of record wear. Both standard and L.P. heads available. **PRICE, £3/12/6.**

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ET'S BUY AN ARGUMENT!

(Continued from Page 77)

dio system, but that is about
ch as one can say. Only a
ıe optimist could expect suc-
ly to restore all the response
sideband cutting.

re are two main reasons for
neither of them very hard
ow.

the first place, the response
10Kc modulating frequency
asily be one hundred or more
down on 1Kc through a con-
nal IF channel. Add the losses
aerial coil and in the de-
circuit and it isn't hard to
ıe need for 40 or 50db of
boost to make it good.

that's a lot of treble boost
ybody's language, and would
r the full resources of a high-
compensating stage, as well as
nant or multi-section network
c the necessary slope to the
nse curve.

ordinary R/C treble-boost cir-
as used in audio amplifiers,
a slope which gradually works
about 6db per octave. It
l be hard put to it to pro-
more than about 15db of boost
een 1 and 10Kc.

NOISE PROBLEM

, even assuming that the re-
e boost is provided, think of
noise problem, with detector
amplifier hiss boosted some 40
0db above normal at the top
of the range. I admit that I've
r checked this statement prac-
y, but the above figures don't
re me to try.

e remaining point has to do
distortion content.

No detector is perfect, nor is the IF amplifier which precedes it. Therefore, all signals emerging from the detector carry some distortion content.

Provided the distortion content remains low, the listener may not be perturbed, but, let it begin to rise, and the said listener starts to turn up his nose.

Here's the rub: A total boost of 40 to 50 db between 1 and 10Kc will mean a slope of 12 to 15db per octave. This means that any second harmonic present in the detector output will be boosted four to five times in magnitude in respect to its fundamental.

MORE DISTORTION

Each higher order of distortion will be boosted progressively more, with rather lamentable effects on the listening quality.

That's why we were cautious in the original article, implying some possible benefit for a small amount of boost. That's all.

The only safe way is to avoid the loss in the first place, and, therefore, avoid the necessity of boosting the treble—along with incidental noise and harmonics.

With FM broadcasting, normal practice is to go even further. The treble is deliberately boosted at the transmitter, retained in the receiver as far as the detector, then reduced in the audio system. Incidental noise and harmonic content is reduced along with it, leaving a signal that can be very, very pure, and very "quiet" indeed.

---

ntrol Units Up-to-date

(Continued from page 39)

ıld never be necessary to use
er values than this.

ensure proper operation of
netic pick-ups, or those using
oling transformers, it is quite
ntial to use a loading resistor
he first grid circuit of a value
mmended by the pick-up
kers.

ailure to do this will often allow
essive output to occur at high
quencies, and a cymbal crash,
instance, on a wide range record,
produce overload unless limited
the resistor. It is quite surpris-
to note just how high a volt-
can be generated in the pick-
circuit in such cases when the
put is fed into an otherwise open
d.

f you have cause to suspect
t your pick-up is giving too high
output, it is quite permissible
use a voltage divider across the
ut terminals to reduce it. The
y point to watch is that the total
istance across the pick-up is equal
the value recommended by the
k-up manufacturer.

For instance, if a .05 meg load is specified, two .025 meg resistors can be used in series, and the grid fed from the centre-point to give a 50 pc reduction in output. Frequency response will not be affected.

A Mantel Set From Old Parts

(Continued from Page 69)

side of the heater circuit should be earthed.

As usual with small sets, the aerial and earth connections are not made to terminals, but to a pair of flying leads brought out through the side of the chassis. Thus the aerial lead is separated from the IF section of the receiver, and no instability is likely to occur from this source.

With the wiring completed the set can be placed into operation. It would be wise to check the voltages with a multimeter before placing the set in the cabinet, to see that all voltages are within the range quoted in this article. In particular the screen and oscillator plate voltages should not be allowed to rise appreciably over 100 volts, when the set is tuned off a station.

Alignment instructions for this and similar sets are given elsewhere in this issue.

AMPLASOUND CO.

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Complete Home Music Systems

No. 1 Frequency Range 35-12000cps

GRAMPION MULLARD 5-10 AMPLIFIER
10 watt amplifier wtih control unit. Selector knob for LP, 78 and Radio — £48/6/-

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We consider the intermodulation distortion from this pick-up to be as low as many high-grade magnetics. — £7/9/1

BAKER 12in De LUXE Speaker.
With cloth suspension for smooth Bass and aluminium dome for extended Treble to 17 kc. — £25/16/4

COMPLETE SYSTEM — £81/11/5

Alternatives for No. 1 System.

FIDEL-O-TONE Turntable	£22/8/-
RONETTE Studio Pick-up	£7/9/1
GOODMANS 150 Speaker	£22/16/10

and many others.

No. 2 Frequency Range 25-18,000 cps.

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Complete with step-up transformer. — £22/8/7

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A turntable for the connoisseur. Low rumble and wow; equal to imported units. — £22/8/-

WHARFEDALE 12/CS/AL Speaker.
The best single unit available in this country with cloth suspension for full bass and huge magnet and aluminium voice coil for extended treble. — £41/4/8

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MBH Moving Iron Pick-up.
with 2 heads, high imp. — £22/14/4

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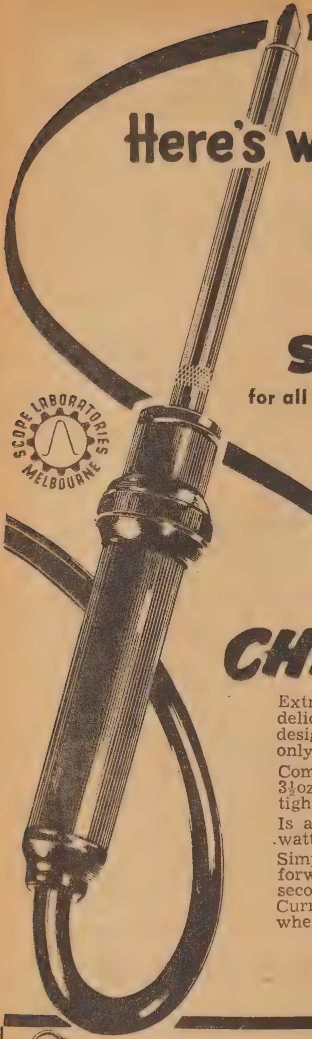

Here's why you'll want to use a SCOPE SOLDERING IRON

for all mechanical, radio and electrical service, instrument and light sheet metal work.

'HOT' IN 6 SECONDS!

There is no waiting when you use a Scope soldering iron. Six seconds after you switch on, Scope is hot and ready for continuous use.

CHECK THESE FEATURES

Extremely suitable for heavy or delicate soldering — Scope's unique design ensures that heat is applied only where and when it's required.

Compact design (10in long, weighs 3½oz), makes soldering easier in tight and awkward places.

Is as effective as irons rated to 150 watts.

Simple to operate—press switch ring forward and the iron is hot in 6 seconds.

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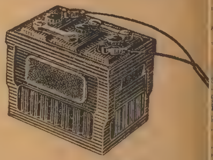
Heats in 6 seconds for continuous use.

Operates from transformer or battery.

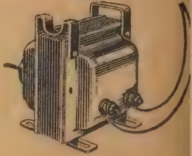
Maintenance is simple — elements and replacement tips are easily screwed in and cost only a few pence.

A maintenance service is available at all times. Scope is fully guaranteed.

OPERATES FROM TRANSFORMER OR BATTERY



Because Scope operates on 2.5/6.3 volts, it is a simple matter to connect it to A.C. mains through a National transformer (optionally supplied) to suit 240V, 50V, or 32V supplies, or to any 4V tap on a 6V or 12V car battery.



NOTE: Since the unusual principle of Scope's operation is so simple, there are few parts and still less to go wrong with it. Soldering tips, elements and other minor accessories are inexpensive and easy to replace —AND ARE ALWAYS AVAILABLE.

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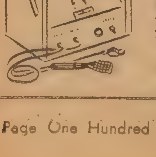

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ANSWERS TO CORRESPONDENTS

H. (Cairns, Q.) requires a receiver e reliable reception of 4QR, 2BL, and VLM, preserving as wide a idth as possible in the circum- s.

We have no first hand knowledge ur location H.L.H., but considering istances involved and comparing with similar local conditions we not like to claim that any set, ercial or otherwise, would give le reception over such distances. st be appreciated that long distance ion is not simply a matter of g bigger and more sensitive sets. et can do no more than pick up ver signal is present and if it isn't all the sensitivity in the world will do no good. We suggest that the ost likely to meet your needs would e Three Band Six of December Unfortunately no thought can be to the question of bandwidth from lity point of view and the aim must r the greatest amount of selectivity can be tolerated.

reply to your second letter we can say that there is not likely to be a deal of difference in the quality of nt day commercial coils and those ged from disposals equipment, ing that the latter are in good tion and were designed with the order of performance in mind. All s considered we feel that there is great deal to be gained in your case, alvaging disposals gear. It would wiser to start from scratch with ew components.

.F. (Wembley) sends us his appreci- of the magazine and also some es as to whether it would be pos- to use a germanium diode as a ier, and to what voltages.

Thank you very much, D.J.F., for kind words. We hope that you will our magazine very interesting for years to come. Now to your query: anium diodes in general are hardly l as power rectifiers, except per- in applications where the DC red is very small. They are mostly in place of thermionic diodes as tors. However, some large Silicon es available overseas, make very and efficient power rectifiers. ough not available here at the ent, there is no doubt that they will me available in the future.

C. (Carlton, Vic.) wonders if it would possible to eliminate the batteries in the ohmmeter circuit of a multi- r by using an AC supply with a dry fier.

: The arrangement you suggest could, often is employed. However, there problems in using a copper oxide or e rectifier to supply power for the r resistance ranges where the current is 10 mA or greater. The internal tance of the rectifier is not constant varies with the current drain. When resistance is an appreciable part of total resistance of the circuit, the ration of the scale will depart from standard as used with battery sup- . Thus a special scale is required the low ohms range. For this reason also because batteries are cheap, for a long time and allow the ument to be completely portable. are used more frequently than the types supply.

? (Bondi Beach, NSW) asks if we e any plans for describing a new) suitable for TV work.

: We are considering a number of s along these lines at the moment eventually a new CRO with extended lities will be described. However, we not as yet make any promises as to n the instrument will appear or what n it will take.

.G.S. (Dundee, Scotland) sends a sub- ption for the following 12 months and s the opportunity to comment on magazine in the light of his experi- e overseas. He also details some of problems associated with servicing, ticularly identifying the various valve es and handling transformerless TV .

.: Your subscription has been forwarded to the appropriate department D.G.S. and an official receipt will be forwarded separately. Many thanks for your comments and comparisons with overseas publications. It is gratifying to know that you still find it so enjoyable and useful. Your comments regarding servicing problems are most interesting, particularly with reference to the valve type numbers. Maybe we should count our blessings; at least we have only two numbering systems to cope with. Thanks also for your suggestions and we will keep these in mind. The voltage readings in particular we have considered for some time and other readers have also made the same suggestion. The disposals articles present a lot of problems and we feel that they would serve only a limited number of readers. For a replacement for the 6M5 we suggest either the EL84 or the 6BQ5 which are almost identical. Socket connections may have to be changed, however.

H.G. (Woodstock, Vic.) wants to know if we can supply details of a radio network which could be used on a farm to contact working parties at distances of up to five miles from the homestead.

A.: Without knowing the frequency allocated by the PMG's department for such a system we would not be able to give specific advice. However, something along the lines of the Bushfire Radio described in November and December 1953 might be satisfactory, even though it is rather larger than you suggest. Copies of these circuits are available through our postal query service. We have had no experience with the beacon receiver which would enable us to say whether it would make a satisfactory car radio. Much would depend on the amount of work which could be devoted to the project and the skill and experience of the builder. In general we feel that it would be better to start from scratch with a kit of parts for something like the KarSet (May 1949, March 1952, or April 1952).

L.R.L. (Modewarre, Vic.) is anxious to build the Simple Set for beginners (October 1955) but wants to know what range this set will have with various size aerials and also if it could be used with a loop aerial.

A.: Sorry, L.R.L. but the question "what is the range of receiver?" is about on a par with the one "how long is a piece of string?" In short, there is no positive answer to such a question. Under favorable conditions at night with a good aerial there should be no difficulty in receiving plenty of interstate stations. On the other hand, in a poor locality, with an inefficient aerial it may be difficult to receive a weak local station at more than 10 miles or so. Loop aerials are not normally fitted to a set as an extra unit, rather they are a special form of aerial coil which is large enough to pick up some signal. If you are interested in equipment of this kind we suggest you consider the Loopstick One of July 1954 issue.

B.A.W. (Cambewarra, NSW) expresses his appreciation of the various articles appearing in Radio, Television and Hobbies and also makes some suggestions regarding the type of articles he would like to see. Finally he submits a small story for the serviceman.

A.: Many thanks for your letter, kind remarks, and criticism, B.A.W., and we will keep these ideas in mind. We try to include as much basic theory as possible in the various articles, including Answer Tom, Serviceman, Lets Buy An Argument, and the various constructional articles insofar as they apply to a particular project. We will pass your letter on to the serviceman for his possible comments but in the meantime we may say that the fault you experienced was not uncommon in the old autodynes. It was not always necessary for the electrolytic to fail in the normal sense, since the efficiency of these devices can be very low at RF and quite enough to upset a critical circuit like the autodyne. A paper by-pass should, of course, be included in the HT circuit as a matter of policy.

D.C. (Box Hill, Vic.) sends in his subscription for the coming year, and at the same time puts the question why "hams" have to change their frequencies.

A.: We have passed your subscription on to the appropriate department, D.C. and by now you should have your receipt from them on hand. Amateurs change bands and frequencies to obtain the best possible conditions for transmission and also to avoid mutual interference. Transmitting conditions on different frequencies change with the time of the day, with times of the year and with sunspot conditions. As a result, a certain band of frequencies may be open

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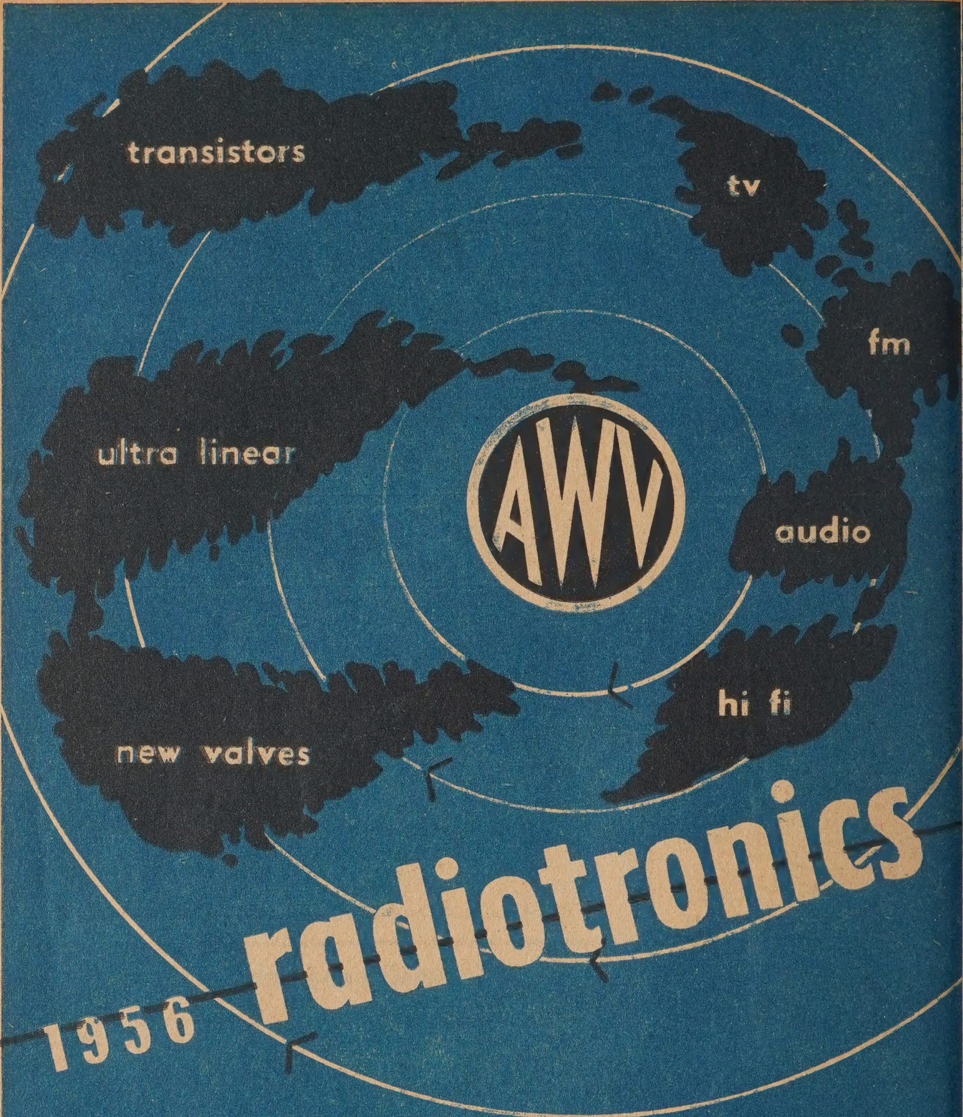
Whatever the subject matter, we must work on the principle that a letter is too involved if the reply takes more than 10 minutes of our time.

Queries not accompanied by the necessary fee will be answered FREE in the columns of the magazine and presented in such a way as to be of interest to other readers.

To those requiring only circuit reprints, &c., we will supply for TWO SHILLINGS diagrams and parts lists from our files covering up to three constructional projects. Scale blueprints showing the position of all holes and cutouts in standard chassis can be supplied for 5/-. These are available for nearly all our designs but please note they do NOT show wiring details.

Address your letters to The Technical Editor, RADIO, TELEVISION and HOBBIES, Box 2728C, GPO, Sydney.

Note that we do not deal in radio components. Price quotations and details of merchandise must be obtained direct from our advertisers.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VCI-56

IOACTIVE
CER TECHNIQUE

Continued from Page 15)

ced, the counter operates a ng signal.

printing is then stopped and ontaminated bath is changed any real damage can occur.

the inspection of metals, par- rly for aircraft purposes, it is tial to ensure that the metal e is free from cracks, for it own that imperfections in the ce have been the cause of e of aircraft components.

easy way to do this kind of ction is to dip the metal in a on containing a radioactive ance (or smear the surface grease containing radioactive rial), then clean the surface dry it.

photographic film is then placed ntact with the surface and left ome time. Enough radioactive rial will have accumulated in surface cracks to affect the film so give a pattern of the cracks.

a similar way leaks and flaws pes and cables may be detected.

hen radioactive tracers are used lants or animals it is essential the dose administered shall be nall that no injurious effect will lt. Usually the radioactive ent is mixed with ordinary -radioactive) substance of the kind in the proportion of one in a million. Fortunately there nstruments that can detect such small amounts.

ABLE FOR ANIMALS

dium can be made radioactive bombarding it or one of its pounds in an atomic pile, with rons. It is suitable for adminis- ion to animals since, for all tical purposes, it ceases to be oactive after about one week.

combination, as sodium chloride ommon salt it can be adminis- d by the mouth. Even with the e small amounts it can be de- ed at the finger tips of a patient in two minutes of administering dose.

the salt solution is injected into blood and a Geiger counter ed against the patient's foot the of circulation of his blood can calculated with very great pre- on. This is a tracer technique ery great importance both to the ent and to the surgeon.

or should the former have to e a leg removed, the circulation would indicate whether there ld be sufficient blood circulating the wound area to help heal it.

the latter, the Geiger counter ld provide guidance as to where amputation should be made so o ensure a good chance of heal-

adioactive phosphorus, which a useful active life of about r weeks, has been shown to be orbed by bone, bone marrow, r and spleen of animals, and it known that bones heal only as as they can absorb phosphorus. periments have been made on s which were anaethetised and n tiny cuts made in their leg es.

he rats were then fed with radio- ive phosphorus measured by ans of a counter. The informa- obtained of the rate of healing has been of value in the treatment of human fractures.

(Continued next month)

ANSWERS TO CORRESPONDENTS

(Continued from Page 117.)

to long distanee communication, whilst other frequencies may not be suitable for more than a couple of hundred miles or less.

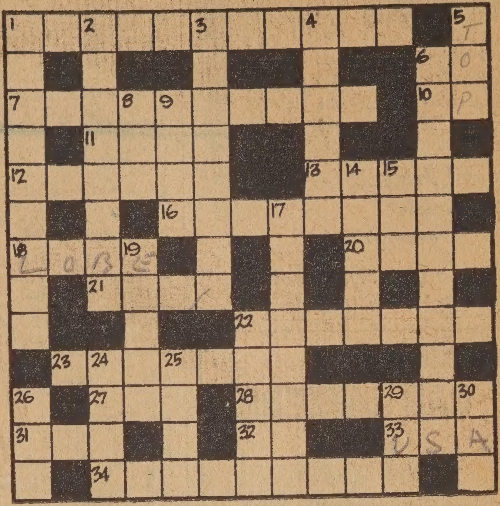
F.P.G. (Drouin, Vic.) asks our advice on an enclosure for the Rola 120X speaker.

A. You could probably do little better than to continue with your original plan and construct the cabinet recommended by the Rola Co. Some of the other cabinets you mention do have advantages in certain cases but unless you are prepared to undertake an experimental campaign, trying cabinets side by side, &c., the simplest plan may be to stick to a cabinet which has been proved for your particular speaker.

H.A. (Wattala, Ceylon) writes to express his appreciation of the magazine and to say that he has learned quite a lot about radio and allied subjects from it. He wants to know if we can supply further details of a device for projecting handwriting on a board or screen as it is being written.

A. Many thanks for the kind remarks, H.A., and we are glad to learn that the magazine has proved so helpful. We trust you will continue to find it interesting and informative. We are afraid we cannot help you very much in regard to the device you mention as we are not quite sure just what form it would take. If you could let us have some further details we may be able to offer some advice. As we remember it, the original device was made up by the Mullard Co. in England for display purposes.

THE R. & H. CROSSWORD No. 23



ACROSS

1. Measure of receiver performance
6. Towards
7. Unit of illumination
10. Above the horizon
11. Midday
12. Ones entitled to elect.
13. Small insect
16. Ejection of electrons
18. Lower part of the ear
20. Bulky pieces of wood
21. To send out
22. Term of sitting
23. A fixed rule
27. To color
28. In the perfect case
31. Middle
32. French for "of"
33. United States of America (abbrev.)
34. Uniting with metallic cement

DOWN

1. Gassy tube (2 words)
2. Fluorescent lamp (2 words)
3. To send signals
4. Small bays
5. Highest part
6. Variable inductors (2 words)
8. Extremity of the foot
9. Part of a transformer
14. Land elevation (pl.)
15. Short for kangaroo
17. Spacer for antenna wires
19. Used as an abrasive
22. Slip
24. Scraps
25. Ground grain
26. Electromotive force (abbrev.)
29. Part of a socket
30. Bark of a small dog

Solution and further crossword next month

Last Month's Solution

C	L	O	S	E	D	C	I	R	C	U	I	T
O	■	P	■	■	I	■	M	■	■	■	■	W
E	M	E	R	Y	P	A	P	E	R	■	■	O
R	■	N	■	■	O	R	E	■	A	R	C	S
C	O	C	K	■	L	O	R	A	N	■	■	T
I	■	I	■	R	E	S	I	N	■	I	■	A
V	E	R	S	E	■	E	A	T	■	N	A	G
E	■	C	O	R	E	■	L	E	A	D	■	E
F	O	U	L	E	D	■	■	N	■	U	■	■
O	■	I	D	A	■	S	■	N	I	C	E	R
R	A	T	E	D	■	P	L	A	T	E	■	I
C	■	■	R	■	A	Y	E	■	E	D	I	T
E	D	I	S	O	N	■	O	H	M	■	■	E

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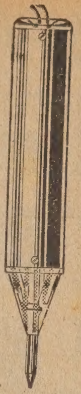

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